CRUISE REPORT

EVALUATION OF THE RELATIONSHIPS AMONG SEGMENTATION, HYDROTHERMAL ACTIVITY AND PETROLOGICAL DIVERSITY ON THE MID-ATLANTIC RIDGE

FAZAR
(French American Zaps and Rocks)

R/V ATLANTIS II

127
Legs 1 and 2

August 29 - October 20, 1992

Lamont-Doherty Earth Observatory of Columbia University
Technical Report No. LDEO-92-3
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INTRODUCTION

We carried out a multi-disciplinary exploration of an extensive length of the mid-Atlantic Ridge that is affected by the Azores hot spot. Our study area extended from south of the Hayes fracture zone at 32°N, to the Kurchatov fracture zone at 40°30'N. The program had two major aims: first, to acquire data sets that would allow an evaluation of the relationships among the petrological composition of the basalts of the ocean crust, the presence of hydrothermal activity, and bathymetric and geophysical characteristics of the ridge; second, to provide the regional framework for the FARA project (French American Ridge Atlantic). This entailed identifying ridge segments with potential active hydrothermal activity, and determining the petrological systematics of the youngest volcanism on the ridge. Identifying hydrothermal segments would be the first step to discovering new hydrothermal vent sites in shallower water and on more enriched basement than the two previously known sites. The petrological studies would establish a baseline for future off-axis and more detailed on-axis studies. The survey work of our FAZAR expedition was to lay the groundwork for more detailed studies of individual ridge segments that are to take place in Phase II of the FARA project, probably in 1994, as outlined in the FARA project plan. Because of logistical considerations, our cruise consisted of two consecutive legs of ship time, which we nonetheless refer to by a single name.

The FAZAR expedition was the second part of a team effort by French-American investigators as part of the FARA program. An earlier cruise, SIGMA, took place in June 1991 on the French research vessel, Atalante. The purpose of the SIGMA cruise (David Needham, Chief Scientist) was multibeam mapping and underway geophysics. The Atalante mapped most of the mid-Atlantic Ridge (MAR) in the vicinity of the Azores, and collected data on gravity and magnetics. The high quality maps, made available by David Needham and others of our IFREMER colleagues, were essential for an efficient and precise sampling program to take place during the FAZAR expedition.

Cruise Plan

Because of ship logistics, the expedition was divided into two consecutive legs, with slightly more than half the time on the second leg. Roughly half the time was to be devoted to rock and half to water work, exclusive of transits, with one extra day for testing of free fall boomerang cores. The first leg was to be devoted to vertical profiling of the water column and broadly spaced rock sampling. The water work was to be done primarily with the French CTD/Rosette system adapted to carry the OSU ZAPS Mn sensor. Segments that seemed active hydrothermally on the first leg were to be revisited and surveyed in more detail using the OSU sled on the second leg, with more intensive rock sampling both in a regional framework and of segments that exhibited end member characteristics in terms of their tectonic style or gravity signature. Some portion of the water time on the second leg was to be devoted to water sampling using the French CTD/rosette of areas that were particularly active, and to a hydrographic experiment in an active segment.

The cruise followed this plan quite closely. However, the plan was modified on the first leg to include work with the OSU sled. This was necessary because the French were unable to bring their chemical analysis van to sea, and hence their system was not able to provide the critical real time data that was necessary to unambiguously identify hydrothermal activity. Data from the OSU sled were essential for planning the second leg. There was also the desire to use the OSU sled during the first leg in order to test equipment and solve any

technical problems prior to the intensive sled work on leg 2. The OSU sled was also equipped with a small rosette, which allowed some water sampling to take place without a CTD/rosette lowering on the second leg.

The cruise was influenced significantly by weather. We extended the work area to the north in order to avoid Hurricane Charley immediately following our port stop in Ponta Delgada. Tropical Storm Bonnie followed closely on the heels of Charley, leading to a loss of two to three days of ship time. Because of the storms we devoted more time to the north than originally anticipated, and a significant amount of the rock sampling time in particular was spent sampling the northern chemical gradient of the Azores hot spot. The water survey work was limited in the northern region, in order to preserve time for detailed studies of potential hydrothermal segments further south.

Although the cruise plan contained slightly more than half the time for rock sampling, the actual time at sea was tilted towards the water programs. This occurred in part because of the competing demands for time by French and OSU investigators, and because fast winch speeds allowed a very efficient rock sampling program. The loss of two and a half days of ship time, 10% of the available science time, led to significant pressure on the time available--and led to one hydrothermally active segment not being investigated in detail. It is regrettable that ship scheduling pushed our cruise into hurricane season, and that neither Woods Hole nor NSF were able to make up for the time lost due to weather. Nonetheless, we were able to more than accomplish the objectives presented in our proposal, with both rock and water programs occupying significantly more stations than anticipated in the proposal.

Discovery of "Lucky Strike" Vent Site

The cruise plan was affected by the serendipitous discovery of a hydrothermal site with a dredge on the first leg (See Figure 1). A dredge of a large seamount in the middle of the rift valley at 37°18'N brought up large fragments of a sulfide chimney covered with mussels, shrimp and other living organisms. The sulfides contained clear pyrite, chalcopyrite and sphalerite as observed by non-sulfide specialists in hand specimen. The dredge also contained hundreds of small (several cm) pieces of very fresh aphyric glass-- fresher than most material recovered on the East Pacific Rise-- and several pillows with extensive hydrothermal alteration and sulfides on the external surfaces. Because of the pre-existing French map, Seabeam coverage of the dredge track during the station, and navigation from the Global Positioning System (GPS), this site is very well located. We had not expected to specifically locate hydrothermal sites during this cruise, and this discovery was particularly fortunate. The certain identification of a hydrothermally active segment made possible a very focussed survey of the water column in the vicinity of the vent site, as discussed in the Zaps section of this report. It also sets the stage for more focussed proposals to be carried out in Phase II of the FARA program.

ROCK SAMPLING AND ANALYSIS

Dredging Operations

Dredging took place off the starboard quarter, with the trawl wire running through the crane, as is usual for the Atlantis II. Dredging was conducted using routine procedures, with a pinger 150m above the dredge. The dredge chain bag was lined with fish netting with about 1cm diameter openings to catch small pieces of rock, and the bottom of the fish netting was lined with a burlap bag to trap very small fragments. The chain bag was weighted with a burlap bag containing about 20kg of metal. This bag served as a glass trap and as a weight to keep the bag from floating during descent. On several dredges, we tied a coffee can in the dredge bag, to try to obtain a sediment sample. Sediments were recovered in the can about 50% of the time.

Fifty-five dredges were carried out at fairly regular intervals along the MAR. Locations of all dredges are given in the attached dredge table (Table 1). Dredging occured predominantly on the ends of segments and the few off-axis targets, because these were the areas that could not be as successfully sampled with rock coring. On the second leg, we also dredged several targets in areas where rock cores had not recovered sufficient sample on the first leg for the full spectrum of chemical analyses. Details of the dredging operations are in the Dredge Log (Appendix l).

Dredge samples were all processed at sea, and reside principally in two locations at Lamont-Doherty Geological Observatory. The working collection of samples, that is, the hand specimens for all samples catalogued in the dredge and rock core inventories, is in the petrology rock storage facility in the basement of the geochemistry building. The remainder of the dredges, which for large dredges is most of the material, is housed in permanent storage in the Lamont Core Lab. A small set of samples from most dredges was also provided to Henri Bougault of IFREMER, France, and those samples reside with him in Brest, France. (See Appendix 5.)

Rock Coring Operations

Rock coring is a technique using a gravity core that has been adapted for the recovery of glass samples from the neo-volcanic zone of ocean ridges. This technique was initiated on one of our previous cruises to the East Pacific Rise, Venture Leg 1. A rock core is simply a modification of the core cutter of a gravity core to a small diameter, hardened steel tip, mostly filled with wax. A hole is placed in the center of the wax to recover a small sediment sample, where sediment is present. Our initial rock cores on the EPR were carried out with a 100kg weight and a single core barrel. Dan Fornari and Mike Perfit modified the technique to include five core tips attached to the end of the barrel. Average recovery on the Venture cruise was 2-3 gm of material, but the mean age of volcanics on the EPR is five times younger than the mean age on the MAR. For this cruise, we were concerned about the older mean age of the volcanics, and also wished to increase the mean sample size, so there would be sufficient sample for complete chemical analyses.

We made several improvements, therefore, to the rock coring system. First, we used a 250 kg weight to increase the impact of the cores on the bottom. Second, we attached a heavy steel collar to the core weight, and the collar was studded with about fifteen additional core heads. This provided a second forceful impact as well as the potential for collecting sample if the gravity core bounced or rolled around within a few feet of the original impact

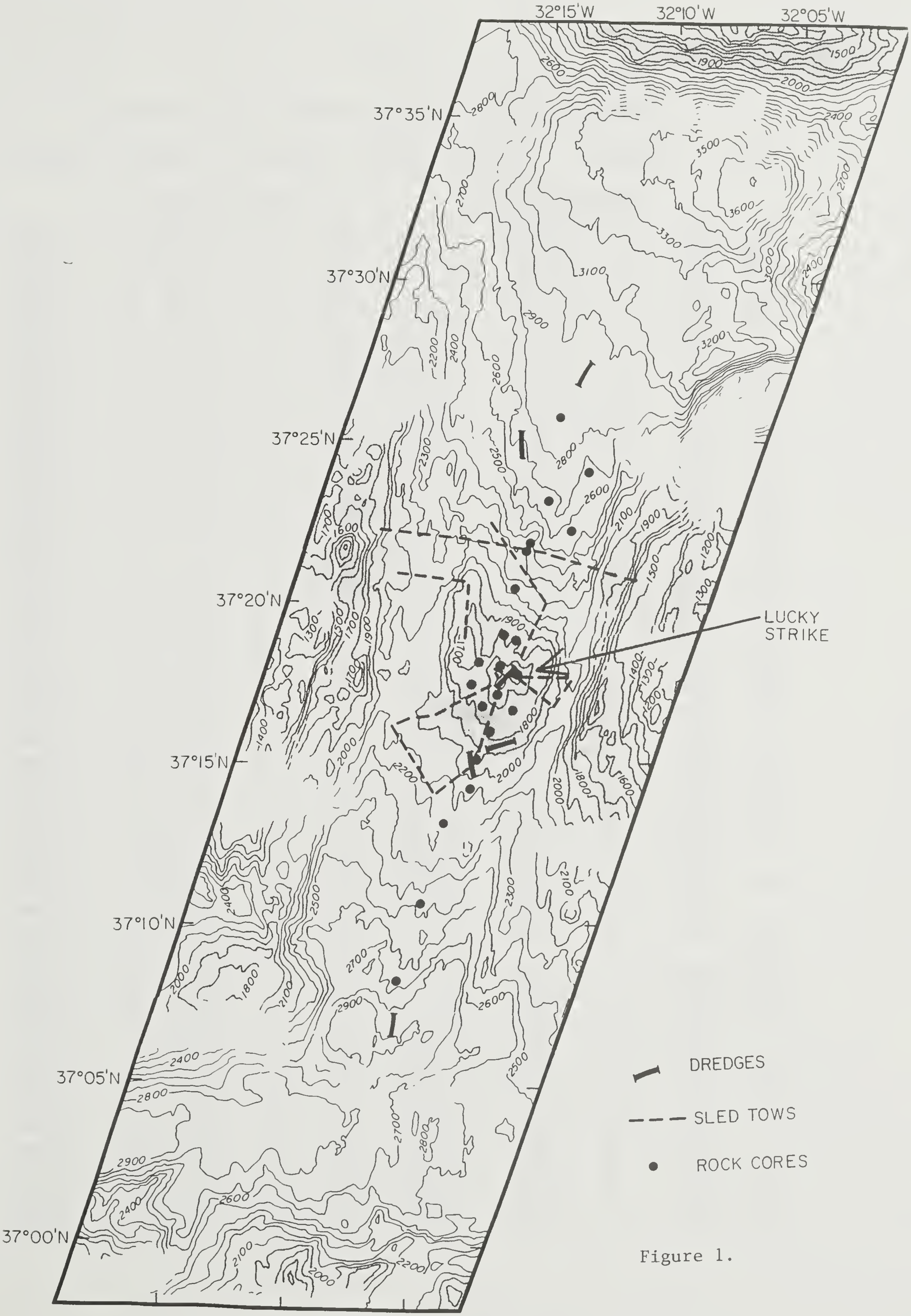

32°15'W
32°10'W
32°05'W
37°35'N
37°30'N
37°25'N
37°20'N
37°15'N
37°10'N
37°05'N
37°00'N
LUCKY STRIKE
DREDGES
SLED TOWS
ROCK CORES

Figure 1.

Table 1

ATLANTIS II 127 (FAZAR Expedition): DREDGE LOCATIONS

Dredge#	Latitude		Longitude		depth	Latitude		Longitude		depth
	On bottom position					Off bottom position				
DR01	33	10.43	39	14.87	2706	33	10.69	39	14.67	2723
DR02	33	43.17	39	3.08	3055	33	43.53	39	2.89	3003
DR03	33	39.00	38	12.30	3895	33	39.64	38	12.04	3917
DR04	33	50.51	37	44.11	3402	33	51.59	37	43.5	3308
DR05	33	54.62	37	42.70	3070	33	54.86	37	41.89	3018
DR06	34	4.88	37	13.25	3467	34	5.23	37	12.55	
DR07	34	20.88	37	6.15	2998	34	21.62	37	5.91	2978
DR08	34	42.49	36	29.14	2789	34	42.60	36	29.87	2678
DR09	35	12.65	34	46.20	1790	35	13.3	34	45.93	1519
DR10	35	56.68	34	10.00	2329	35	57.59	34	9.69	2304
DR11	36	9.12	33	59.13	3053	36	9.64	33	58.51	3043
DR12	36	17.03	33	45.65	2378	36	18.22	33	45.34	2195
DR13	36	59.06	32	56.75	2660	36	59.86	32	56.16	2719
DR14	37	3.71	32	53.31	2985	37	3.18	32	54.48	2941
DR15	37	17.43	32	16.95	1706	37	17.94	32	16.2	1617
DR16	37	27.48	32	13.49	2952	37	26.74	32	13.98	2879
DR17	37	50.18	31	31.09	1009	37	50.76	31	31.46	843
DR18	37	58.76	31	28.26		37	59.45	31	28.13	1725
DR19	38	7.36	30	43.59	1877	38	7.72	30	43.58	1957
DR20	38	17.77	30	41.16	800	38	18.35	30	40.64	750
DR21	38	29.45	30	15.92	2095	38	30.05	30	15.46	1822
DR22	39	2.27	30	1.50	1386	39	3.25	30	1.84	
DR23	38	40.29	29	15.32	1785	38	40.25	29	15.07	1724
DR24	40	31.35	29	32.20	2920	40	31.53	29	31.63	3047
DR25	40	15.48	29	35.73	2505	40	16.74	29	35.66	2390
DR26	39	54.47	29	40.33	2068	39	54.42	29	41.59	2117
DR27	39	30.31	29	44.27	2288	39	30.12	29	44.46	
DR28	39	29.88	29	53.96	1880	39	30.21	29	54.31	1990
DR29	39	25.92	29	50.73	1860	39	26.49	29	51.2	
DR30	38	45.21	30	5.78		38	45.01	30	5.61	980
DR31	38	47.80	30	2.40	1200					1100
DR32	38	3.74	31	24.70		38	3.475	31	26.248	2397
DR33	38	2.88	31	26.74		38	2.38	31	26.69	2050
DR34	37	35.39	31	36.13	1950	37	35.05	31	36.19	1999
DR35	37	25.27	32	16.19	2728	37	24.542	32	16.186	
DR36	37	15.37	32	17.27	2274	37	15.722	32	16.158	2267
DR37	37	15.34	32	17.98	1959	37	14.66	32	17.7	1967
DR38	37	6.66	32	20.85	2930	37	7.21	32	20.87	
DR39	36	47.54	33	25.78	1100	36	46.66	33	26.21	
DR40	35	46.72	34	13.44	2514	35	46.2	34	13.63	2373
DR41	35	39.93	34	16.98	2760	35	40.58	34	16.69	2634
DR42	35	40.30	34	27.46	3138	35	39.67	34	27.93	3091

ATLANTIS II 127 (FAZAR Expedition): DREDGE LOCATIONS

Dredge#	Latitude		Longitude		depth	Latitude		Longitude		depth
	On bottom position					Off bottom position				
DR43	35	31.46	34	46.94	3226	35	30.91	34	47.12	3074
DR44	35	19.54	34	51.56	2396	35	19.02	34	51.67	
DR45	35	17.72	34	51.87	2435	35	18.41	34	51.88	
DR46	35	14.21	34	49.01	2038	35	15.00	34	49.34	1822
DR47	35	9.50	34	40.77	1614	35	10.9	34	41.74	1141
DR48	35	5.45	34	56.76	4083	35	6.3	34	57.62	3830
DR49	35	15.05	36	15.29	3797	35	15.8	36	16.25	
DR50	34	50.28	36	25.80	2197	34	50.71	36	26.14	
DR51	34	49.14	36	21.20	1743	34	50.08	36	21.09	
DR52	34	34.47	36	30.98	3000	34	34.83	36	31.81	2930
DR53	34	31.48	36	59.57	3115	34	31.54	36	59.99	3009
DR54	34	4.03	37	38.97	3397	34	2.99	37	38.7	
DR55	33	43.35	37	46.84	3860	33	43.61	37	47.23	3736

site. Third, we attached cylinders of wax around the outside edge of the core heads, so that the cutting edge had wax on both internal and external surfaces. All of these improvements were successful. On most deployments, several of the cores on the collar contained sample, and sample was almost always recovered in the wax around the core cutters as well as the wax within the core cutters. Because of the greater mean age of the MAR, many deployments recovered a significant sediment sample as well. Therefore despite the more hostile terrain for rock coring on the MAR as compared to the EPR, our improvements led to far greater sample recovery than we had obtained on the EPR. The average sample recovery was 13.2 gm of material, of which 7gm was glass or rock. Many rock cores contained more than 15gm of material. Two thirds of the rock cores contained enough material for complete chemical analyses, including trace elements and isotopes. The rock cores also provided an extensive set of sediment samples from the rift valley.

Rock coring had an additional use that became apparent during the cruise. The freshness of the glass recovered was a clear indication of whether we had sampled the neovolcanic zone, or were on older lavas within the rift valley. This technique was used successfully on the second leg to locate the neovolcanic zone prior to undertaking the systematic along-strike sampling of a segment. Although dredging can also provide such information, dredging picks up mostly talus, the sample location is uncertain, and dredging takes several hours. Rock coring, however, took just 35 minutes in 2500 meters of water, allowing a series of five cores to be undertaken in the time it would take to do a dredge.

Other mechanical improvements facilitated the operation of the rock core. Deployment and recovery of the rock core was aided by the construction of a stand that was welded to the deck, and kept the rock core in a vertical position. The impact of the core on the bottom is also very intense, so all materials need to be very strong. The first collar, constructed of 1/8 inch steel, was routinely knocked off the core, and ultimately was destroyed. Attachment of a safety line to the collar was essential. We had a new collar design constructed for the second leg using 3/8 inch steel, which was highly successful. Core heads were threaded so they could be screwed in and out of the collar, making their replacement simple and rapid. Although rock coring is a rapid and simple sample recovery method, it can be labor intensive, particularly in shallow water. Each station can result in processing and preparing ten or more core heads, and deployment and recovery can occur every half an hour in shallow water.

It had been reported to us that hydro-winch speeds on the Atlantis II were likely to be 80-90 meters per minute, significantly slower than we had experienced on other ships in the past. However, the winch was able to routinely operate at 150 meters/minute, which was directly responsible for the larger number of rock cores we were able to obtain than had been originally planned. Rapid winch speeds are very important to the efficacy of the technique, since speed as well as precision are its principal advantages over dredging.

One hundred fifty two rock cores were carried out. Locations for the rock cores are given in the attached Table 2, along with an inventory of the recovered samples. All rock core samples reside with C. Langmuir in the petrology group at Lamont-Doherty.

Free Fall Boomerang Cores

During the cruise we carried out a number of tests of a free fall boomerang core designed by Analytical Services Corporation. Initial tests were carried out during a test cruise on R/V Wecoma on the Gorda ridge. The sampler failed these tests. It often did not return from the bottom, and when it did return it did not recover significant sample. As a result of this failure, we contributed to a redesign of the free fall core, and eliminated the explosive

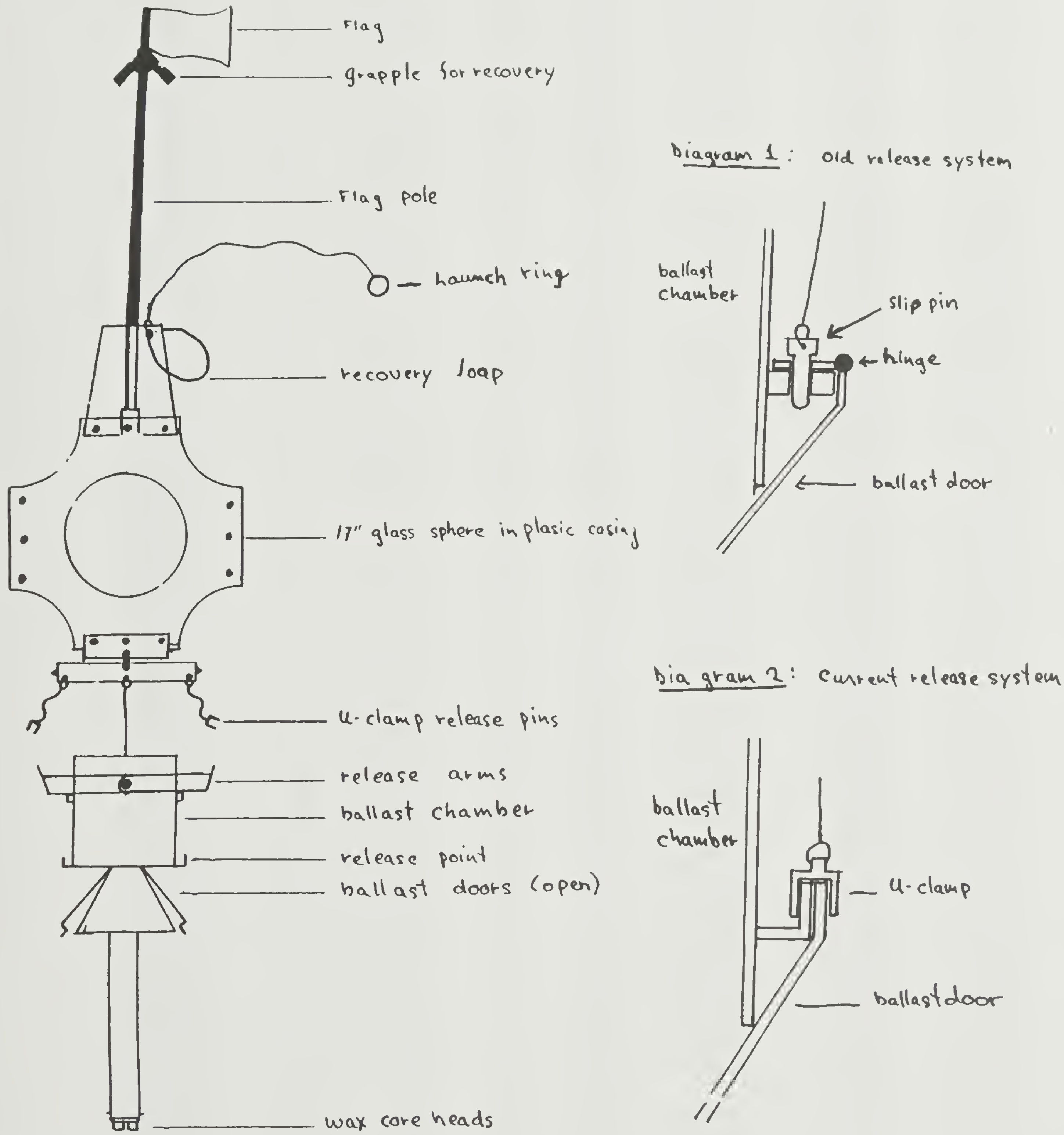
A

B

C

D

igure 2a: The rock coring system used during the FAZAR xpedition. Photo A shows the complete rock core in its and, ready for deployment. The yellow float in the photo is ot part of the rock core. On the end of the asssembly are five ore heads (Photo B). Each core head is filled with wax, with large hole through the center and surrounded by a "donut" of ax held in place with a tie wrap. The entire core head ssembly can be removed from the core pipe for sample rocessing and preparation for the next deployment. The eight is 13" diameter of solid Pb, weighing approximately 50kg. Around the weight is the "collar" which contains five ndividual core heads, each removable separately (Photo C). During deployment, both the core head assembly and the collar re secured with safety lines, in case they are knocked lose by he impact. Photos C and D show typical results from a rock ore. C is a close-up of the collar upon recovery. The black naterial is basaltic glass, stuck in the white wax. D is the ore head assembly after a typical recovery.



FREE FALL BOOMERANG ROCK CORE
October 1992

Figure 2b

Table 2. Rock Core Locations

RC No.	Latitude (N)		Longitude (W)		Depth	LAT	LONG
	Deg.	Min	Deg.	Min.	Meters	Deg.	Deg.
RC01	33	15.36	39	14.79	2294	33.256	39.247
RC02	33	20.45	39	8.46	2097	33.341	39.141
RC03	33	28.58	39	7.93	2497	33.476	39.132
RC04	33	36.60	38	13.41	4377	33.610	38.224
RC05	33	45.95	37	45.19	3562	33.766	37.753
RC06	33	58.40	37	41.30	3073	33.973	37.688
RC07	34	1.51	37	40.03	3050	34.025	37.667
RC08	34	9.89	37	10.09	3084	34.165	37.168
RC09	34	16.19	37	7.35	3168	34.270	37.123
RC10	34	27.10	37	3.52	2822	34.452	37.059
RC11	34	30.69	37	1.70	2983	34.512	37.028
RC12	34	33.80	36	33.29	2832	34.563	36.555
RC13	34	47.17	36	27.77	2283	34.786	36.463
RC14	34	54.24	36	25.47	2201	34.904	36.425
RC15	35	5.98	36	22.73	2813	35.100	36.379
RC16	35	15.97	36	21.04	3550	35.266	36.351
RC17	35	13.56	34	52.89	2867	35.226	34.882
RC18	35	18.29	34	51.84	2240	35.305	34.864
RC19	35	19.31	34	52.93	1981	35.322	34.882
RC20	35	27.77	34	49.43	2801	35.463	34.824
RC21	35	42.72	34	15.43	2360	35.712	34.257
RC22	35	52.84	34	11.32	2404	35.881	34.189
RC23	36	3.27	34	7.65	2566	36.055	34.128
RC24	36	9.39	33	58.70	2980	36.157	33.978
RC25	36	21.65	33	40.10	2584	36.361	33.668
RC26	36	33.61	33	36.67	2738	36.560	33.611
RC27	36	36.01	33	20.82	3043	36.600	33.347
RC28	36	39.57	33	19.93	2681	36.660	33.332
RC29	36	41.38	33	19.52	2691	36.690	33.325
RC30	36	43.10	33	18.57	2640	36.718	33.310
RC31	36	51.34	33	15.27	2770	36.856	33.255
RC32	36	52.55	33	14.27	2793	36.876	33.238
RC33	36	53.87	33	13.56	2870	36.898	33.226
RC34	36	56.41	32	59.28	2892	36.940	32.988
RC35	36	56.97	32	58.02	2676	36.950	32.967
RC36	36	58.44	32	56.98	2692	36.974	32.950
RC37	37	1.07	32	55.60	2763	37.018	32.927
RC38	37	1.97	32	54.79	2752	37.033	32.913
RC39	37	8.17	32	20.69	2663	37.136	32.345
RC40	37	13.05	32	18.94	2176	37.218	32.316
RC41	37	17.02	32	16.83	1561	37.284	32.281
RC42	37	18.11	32	17.51	1768	37.302	32.292
RC43	37	17.84	32	16.88	1614	37.297	32.281
RC44	37	23.22	32	15.00	2570	37.387	32.250

RC No.	Latitude (N)		Longitude (W)		Depth	LAT	LONG
	Deg.	Min	Deg.	Min.	Meters	Deg.	Deg.
RC45	37	35.95	31	35.96	1971	37.599	31.599
RC46	37	42.68	31	33.49	1421	37.711	31.558
RC47	37	47.94	31	31.93	1018	37.799	31.532
RC48	37	53.33	31	30.20	1365	37.889	31.503
RC49	37	57.10	31	29.96	1581	37.952	31.499
RC50	38	8.37	30	43.47	1794	38.140	30.725
RC51	38	7.53	30	42.78	1827	38.126	30.713
RC52	38	17.52	30	38.53	355	38.292	30.642
RC53	38	18.73	30	37.05	762	38.312	30.618
RC54	38	21.19	30	35.64	839	38.353	30.594
RC55	38	18.68	30	33.86	1017	38.311	30.564
RC56	38	24.55	30	33.76	1647	38.409	30.563
RC57	38	26.71	30	16.47	2170	38.445	30.275
RC58	38	32.47	30	14.95	1944	38.541	30.249
RC59	38	36.45	30	13.46	1485	38.608	30.224
RC60	38	39.66	30	11.57	1170	38.661	30.193
RC61	38	43.24	30	10.14	1222	38.721	30.169
RC62	38	48.23	30	8.19	1352	38.804	30.137
RC63	38	49.70	30	5.24	1240	38.828	30.087
RC64	38	53.20	30	4.37	1190	38.887	30.073
RC65	38	56.66	30	3.55	1300	38.944	30.059
RC66	39	3.52	30	1.62	1279	39.059	30.027
RC67	40	28.88	29	32.65	2835	40.481	29.544
RC68	40	25.28	29	33.19	2757	40.421	29.553
RC69	40	23.10	29	33.13	2613	40.385	29.552
RC70	40	19.09	29	33.20	2480	40.318	29.553
RC71	40	16.28	29	33.45	2399	40.271	29.558
RC72	40	17.43	29	35.04	2420	40.291	29.584
RC73	40	14.31	29	34.43	2559	40.239	29.574
RC74	40	12.22	29	36.60	2914	40.204	29.610
RC75	40	9.77	29	39.45	2748	40.163	29.658
RC76	40	8.30	29	36.51	2596	40.138	29.609
RC77	40	6.80	29	38.80	2492	40.113	29.647
RC78	40	4.71	29	39.69	2560	40.079	29.662
RC79	40	2.43	29	40.34	2404	40.041	29.672
RC80	39	58.42	29	41.70	2156	39.974	29.695
RC81	39	58.42	29	40.63		39.974	29.677
RC82	39	48.09	29	42.12	2172	39.802	29.702
RC83	39	43.77	29	43.19	1960	39.730	29.720
RC84	39	39.53	29	44.22	1820	39.659	29.737
RC85	39	34.63	29	44.99	1970	39.577	29.750
RC86	39	21.77	29	56.25	1735	39.363	29.938
RC87	39	18.39	29	56.91	1662	39.307	29.949
RC88	39	15.27	29	57.78	1661	39.255	29.963

RC No.	Latitude (N)		Longitude (W)		Depth	LAT	LONG
	Deg.	Min	Deg.	Min.	Meters	Deg.	Deg.
RC89	39	10.06	29	58.83	1523	39.168	29.981
RC90	39	6.23	30	1.18	1210	39.104	30.020
RC91	38	59.58	30	2.35	1338	38.993	30.039
RC92	38	47.95	30	1.78	660	38.799	30.030
RC93	38	34.52	30	13.56	1792	38.575	30.226
RC94	37	58.70	31	29.00	1713	37.978	31.483
RC95	37	54.88	31	29.97	1537	37.915	31.500
RC96	37	50.73	31	32.14	823	37.846	31.536
RC97	37	50.13	31	30.32	811	37.836	31.505
RC98	37	49.29	31	31.82	1042	37.822	31.530
RC99	37	45.93	31	32.82	1312	37.766	31.547
RC100	37	43.78	31	32.50	1338	37.730	31.542
RC101	37	41.13	31	33.51	1594	37.686	31.559
RC102	37	39.45	31	34.34	1773	37.658	31.572
RC103	37	15.15	32	17.60	1864	37.253	32.293
RC104	37	16.00	32	17.12	1804	37.267	32.285
RC105	37	17.46	32	17.97	1770	37.291	32.300
RC106	37	16.60	32	16.19	1707	37.277	32.270
RC107	37	18.73	32	16.02	1808	37.312	32.267
RC108	37	18.98	32	16.71	1801	37.316	32.279
RC109	37	20.46	32	16.17	2125	37.341	32.270
RC110	37	21.56	32	15.76	2207	37.359	32.263
RC111	37	22.27	32	14.05	2558	37.371	32.234
RC112	37	24.00	32	13.43	2617	37.400	32.224
RC113	37	24.65	32	16.18	2658	37.411	32.270
RC114	37	25.67	32	14.63	2836	37.428	32.244
RC115	37	17.83	32	16.16	1600	37.297	32.269
RC116	37	16.70	32	17.44	1755	37.278	32.291
RC117	37	14.16	32	17.78	2083	37.236	32.296
RC118	37	10.61	32	19.73	2466	37.177	32.329
RC119	36	54.72	33	14.11	2765	36.912	33.235
RC120	36	34.81	33	35.96	2877	36.580	33.599
RC121	36	34.51	33	38.02	2844	36.575	33.634
RC122	36	31.18	33	37.22	2626	36.520	33.620
RC123	36	23.63	33	39.15	2560	36.394	33.653
RC124	36	24.67	33	38.01	2480	36.411	33.634
RC125	36	23.75	33	39.71	2640	36.396	33.662
RC126	36	27.59	33	37.23	2267	36.460	33.621
RC127	36	27.90	33	37.74	2510	36.465	33.629
RC128	36	28.66	33	38.62	2610	36.478	33.644
RC129	36	30.11	33	39.04	2739	36.502	33.651
RC130	35	59.49	34	8.62	2367	35.992	34.144
RC131	35	49.91	34	12.13	2505	35.832	34.202
RC132	35	39.93	34	27.75	3080	35.666	34.463

RC No.	Latitude (N)		Longitude (W)		Depth	LAT	LONG
	Deg.	Min	Deg.	Min.	Meters	Deg.	Deg.
RC133	35	29.52	34	48.00	2930	35.492	34.800
RC134	35	24.92	34	50.31	2493	35.415	34.839
RC135	35	23.87	34	50.89	2318	35.398	34.848
RC136	35	21.51	34	51.04	2367	35.359	34.851
RC137	35	19.94	34	51.43	2340	35.332	34.857
RC138	35	16.63	34	52.71	2550	35.277	34.879
RC139	35	12.40	34	53.48	3028	35.207	34.891
RC140	35	9.71	34	54.26	3222	35.162	34.904
RC141	35	9.97	36	19.83	3139	35.166	36.331
RC142	35	6.51	36	20.84	2995	35.109	36.347
RC143	35	3.49	36	21.67	2667	35.058	36.361
RC144	34	58.80	36	23.60	2344	34.980	36.393
RC145	34	56.24	36	24.73	2176	34.937	36.412
RC146	34	45.31	36	28.61	2489	34.755	36.477
RC147	34	43.55	36	27.74	2546	34.726	36.462
RC18	34	38.01	36	30.03	2744	34.634	36.501
RC149	34	12.77	37	9.24	3197	34.213	37.154
RC150	33	56.61	37	41.72	3043	33.944	37.695
RC151	33	53.06	37	42.83	3167	33.884	37.714
RC152	33	48.86	37	44.49	3388	33.814	37.742

device that was being used for sampling. Analytical Services built six of the redesigned cores, but did not have sufficient time to make all the desired modifications. (See Figure 2.)

The redesigned cores with no explosive charge successfully recovered glass samples, but could not be relied on to return from the bottom. The tests show, therefore, that the free fall corer is a valid rock sampling tool which deserves further development, but the current design is not adequate.

The advantages of the free fall corer are speed of sample recovery. If the ship is handled efficiently, free fall cores could be deployed sequentially at half kilometer spacing over a distance of several miles. In a three hour time period, eight to ten cores could be deployed and recovered in average ridge water depths. This is a speed of sampling that is an order of magnitude more efficient than dredging, and a factor of two to three more efficient than rock coring. However, this efficiency requires a very high recovery rate, for much time can be lost looking for an absent core. Recovery rates of 98% would be desirable.

Free fall cores would also have great advantages as being part of a submersible program. During the day, the ship cannot be used when the submersible is submerged, due to safety considerations. However, deployment and recovery of free fall cores could take place during this time, since the ship is always free to maneuver.

In our initial tests of the free fall cores, we deployed two boomerangs in succession. The recovery rate for the first six deployments was 66%. We carried out further tests in combination with a normal rock core. We would first launch the boomerang core, then carry out a rock core, and then recover the boomerang. Wire speeds for the rock core were faster than the travel of the boomerang, so in principal we could obtain two samples in almost the same time as a single rock core.

A complete table of free fall deployments is attached (Table 3). Of the fourteen boomerangs deployed, eight resurfaced. The average time in the water was 75 minutes in an average water depth of 2500 meters. To launch the corer, it was placed in its deck stand, and the ballast doors closed and secured with U-clamp pins. We would then fill the ballast contained with about 250lbs. of fine steel punchings, and all movable parts would be sprayed with silicone. The core would then be lifted over the side with an air winch and released with a snap release.

Because of the poor recovery rate, we carried out many modifications of the free fall core design with the help of the ship's engineers. The original design of the release system had two ballast doors and a hinge latch that was released by a slip pin (see attached figure). The pin tended to bind from the weight of the ballast, and hence was changed to a U-clamp system (see figure). Release was initiated by the jostling resulting from impact with the bottom, which was planned to release the float, which would pull up the pins, letting the ballast doors open and the ballast fall out.

There was much speculation concerning the cause of failure of the cores. We tested the glass spheres by sending them to the bottom on a wire, and the glass spheres were not the problem. Another idea was that the cores stuck in sediment. However, the original prototype had been tested in sediment off the coast of California and returned several times without failure. We think that the cause of failure had to do with the ballast doors. If the core were to fall on its side before the ballast released, the doors would be blocked from opening. The design was modified so that four ballast doors could open instead of two, but this did not lead to any improvement in recovery.

Table 3. Free Fall Core Locations

	LATITUDE		LONGITUDE		
FF01	33	20.52	39	8.54	2099
FF03	34	22.60	37	5.54	2954
FF04	34	23.10	37	5.24	2855
FF07	34	46.88	36	27.74	
FF11	37	21.58	32	15.67	2205
FF13	36	23.77	33	39.74	2662

The lack of reliability of the free fall cores leads us to conclude that a major change in the design of the ballast and release system is necessary. The free fall core remains an intriguing concept and a potential improvement in sampling efficiency, but the current design is not adequate.

Shipboard Sample Processing

All rock samples were extensively processed on board ship. Detailed methods used for rock processing are presented in Appendix 8. Rock cores ended up commonly with four samples, glass from the wax, sediment, glass chips enclosed in the sediment, and the sediment remaining once the glass had been removed. The glass sample was usually crushed and sieved leading to a clean glass fraction that was used for plasma analysis, and from which chips were taken to prepare disks for the lectron microprobe. Dredges were thoroughly described, divided into types, and several samples were selected from each type. Each sample had glass removed, a thin section chip made and cut surfaces described, and the glass was crushed and cleaned, providing a clean glass fraction for plasma analysis, electron microprobe chips, and further chemical analysis on shore. Details of these procedures are presented in Appendix 8.

Shipboard Analysis by Plasma Spectrometry

Major element analyses of basalt solutions were performed by DC plasma on both legs of the FAZAR expedition. During transit to the MAR, the plasma was set up and standards were analysed as a test of data quality. Once on site, fusion of a batch of between 9 and 11 samples and one standard took place every two to three days. The final transit to Woods Hole was used to verify and tabulate data. Analyses from leg 1 proved invaluable for choosing sampling locations on leg 2.

Although on the initial transit the plasma performed well and produced data for standards within acceptable values, once on site it was discovered that the jet power supply was sensitive to power fluctuations caused when major pieces of ship equipment used for science operations were turned on or off, causing the plasma jet to shut off. This problem was solved by having both ships generators running during daytime hours and operating the plasma only during that period. The electrical problems led to a loss of about a week of analysis time, and meant that the plasma was not able to operate at night.

Techniques for preparing basalt solutions at sea differ somewhat from those used on land. Lithium metaborate flux, standard powders, and "hi" standard powders were preweighed at Lamont. Approximately 50 mg of clean basalt chips (50 mg was chosen by comparing the volume of the unknown chips with preweighed chips of similar size) were placed on top of 300 mg of flux in a graphite crucible and fused. The molten material was then dissolved in 100 ml of 1N HNO_3. Nine elements were analysed for each solution, Si, Al, Mg, Fe, Ca, Na, Ti, Sr, and Ba.

Data reduction is based on normalizing emission counts to a known solution, referred to as a "hi" standard. On FAZAR we used K1919, an internal Lamont basalt standard from the 1919 flow at Kilauea, which is the source of the BHVO standard, as our "hi". K1919 was run every third or fourth analysis. Each sample was normalized to K1919 to determine the concentration of each element in solution. Corrections were applied for non-linearity of the Na peak and matrix effects on the Si peak. The sum of the concentrations was then normalized to 99.5%. This normalization step was necessary because of the inability of weighing the samples precisely at sea. The un-normalized sum reveals the actual sample weight, which was generally within a 5-10 mg of 50mg. Each sample was analysed twice

for each element, and the two analyses were averaged for the final data. As a test of data quality for each run, one known standard was analysed with each batch of unknowns. A compilation of the standard analyses is given in the attached Table 4. Data for most elements have standard deviations from run to run of less than 2%.

Fifteen batches of basalt solutions provided analyses of 145 unknowns, including an analysis of a basalt from the Azores hotspot (Sao Miguel). Unknowns were chosen for shipboard plasma analysis based on the abundance of basalt glass and the location of the sample. Each rock core was analysed if enough material was available, at least 1 to 3 individual samples from each dredge were analysed. Plots of chemical composition were made as the analyses became available and sampling plans were made based on the results. Analysis of the results of Leg 1 contributed to the sampling of Leg 2.

Table 4

	SHIPBOARD PLASMA DATA QUALITY								
	REPLICATE ANALYSES OF LDGO STANDARD CHEPR 25								
	SiO2	Al2O3	FeO	MgO	CaO	Na2O	TiO2	Ba	Sr
Batch 1	50.22	15.62	9.85	7.53	10.87	3.00	1.91	33.3	177.
Batch 6	50.39	15.79	9.57	7.43	10.87	3.07	1.89	33.7	175.
Batch 7	50.36	15.54	9.7	7.45	10.94	2.98	1.91	32.0	185.
Batch 8	50.24	15.59	9.64	7.55	10.99	3.08	1.92	32.8	181.
Batch 9	49.97	15.49	9.62	7.63	11.24	3.22	1.90	34.4	184.
Batch 10	51.04	15.05	9.55	7.37	11.23	2.82	1.94	34.3	178.
Batch 12	50.01	15.74	9.83	7.43	11.11	2.95	1.93	33.5	180.
Batch 13	50.44	15.51	9.75	7.34	11.06	2.98	1.92	32.9	177.
Batch14	49.81	15.89	9.77	7.55	11.04	3.07	1.87	34.8	180.
Batch 11	49.97	15.66	9.77	7.37	11.20	3.09	1.94	33.8	180.
Batch 15	50.57	15.36	9.62	7.44	11.02	3.07	1.91	34.3	178.
Average	**50.27**	**15.57**	**9.70**	**7.46**	**11.05**	**3.03**	**1.91**	**33.6**	**180.**
%Std Dev	0.7	1.5	1.1	1.2	1.2	3.3	1.1	2.4	1.6
without	**50.20**	**15.62**	**9.71**	**7.47**	**11.03**	**3.05**	**1.91**	**33.5**	**180.**
Batch 10	0.5	1.0	1.0	1.2	1.1	2.5	1.1	2.5	1.7
Recommended	**50.4**	**15.65**	**9.86**	**7.55**	**10.95**	**3.12**	**1.96**	**34**	**182**
Values									

ROSETTE-CTD OPERATIONS

Objectives

The description and the quantification of exchanges between the Ocean and the Lithosphere along the active Mid-Ocean Ridge system is a major scientific goal : these exchanges are dealing with both the functioning of the Ridge system itself and with the physico-chemical properties and processes involved in the Ocean. The record of this interaction can be made at different scales in space and time through hytrothermal tracers in the water column and from the sediment composition at or in the vicinity of the ridge axis.

One of the objectives of the FAZAR cruise (AII-127), part of the French American FARA program, was to describe the hydrothermal activity, and as far as possible to locate active hydothermal areas, along the Mid-Atlantic ridge between Hayes Fracture Zone (33°N) and the Azores Triple Junction (39°N). This approach is based on physico-chemical anomalies created in the water column above active hydrothermal areas.

We hope to be able to make the difference between two types of Ocean-Lithosphere interactions. One type is represented by hot hydrothermal discharges on volcanic or neovolcanic basaltic ridges, "zero-age" located. Many examples of these are known on the East-Pacific Rise but only two sites are known so far on the MAR: the Snake Pit and TAG sites. This type of hydrothermal discharge produces a plume, stabilized 200 to 300 m above the discharge area, characterized by high Mn/CH_4 ratios, with CH_4 concentrations in seawater up to 100 nl/l; the maximum recorded in the plume so far is 250 nl/l. The second type has been recently proven to be correlated to occurrences of ultramafic outcrops on the walls of the rift valley of the MAR in the area of 15°N (Bougault et al., Oceanologica Acta, 10, 199-207, 1990). It is thought to be diffuse, low temperature discharge: it is characterized by low Mn/CH_4 ratios (Charlou et al., *Geochim. et Cosmochim. Acta, 55, 12*, 1991; Bougault et al.,*J. Geophys. Res.*, in press); the CH_4 concentration over ultramafic bodies is currently 400 nl/l and values of up to 800 nl/l were recently recorded in a plume located within the rift valley at 3200 m depth, 1200 m above the seafloor, whose origin is highly probably on the walls (FARANAUT 15N cruise, March-April 1992), (Bougault et al., Charlou et al., *Eos*, December 1992) .

Strategy

The map of the MAR between Hayes and the Azores Triple Junction was previously made during a cruise of the French R/V l'Atalante in 1991, as a part of the FARA program (SIGMA cruise, chief scientist H.D. Needham), by using the EM12 Simrad multibeam swath echo-sounder. The first leg of the FAZAR cruise was dedicated to collect real time data related to possible occurrences of hydrothermal activity along the ridge axis by conducting vertical hydrocasts, about one to three per segment (about 15 miles in length average), and to collect seawater samples for on shore analysis of Mn, CH_4 and He. These hydrocasts were made with the IFREMER CTD-Rosette unit, on which the ZAPS Mn sensor from OSU was tied up. The location of possible hydrothermal activity was thus planned to be based on physical parameters (nephelometry, temperature) and on one chemical tracer (Mn).

The objective of the second leg of FAZAR was to locate more accurately "hot" hydrothermal areas, on the ground of data collected during Leg 1, by using the SLED equipment of OSU. Seawater sampling with the IFREMER CTD-Rosette unit was still planned during this second leg to get data just over the "hot" hydrothermal areas located with the SLED.

Equipment

The IFREMER CTD-Rosette unit is made of a frame where 16 Niskin type bottles (8 liter capacity, equiped with non contaminant silicon rubber) are attached, a system to command the sequential closing of the bottles, the CTD itself (a Seabird SBE 9, 24 Hz sampling, with temperature, conductivity, Paroscientific Digiquartz pressure sensors, and dissolved oxygen Beckman probe) and a Prieur type nephelometer. The CTD-Rosette was attached to a conductive cable specially installed on board the AII to conduct the SLED and CTD-Rosette operations. On board the ship, a deck unit (Seabird SBE 11) makes the interface between the CTD-Rosette and a PC computer, providing the supply to the CTD-Rosette unit, transmitting the data to the computer and transmitting the order to fire the bottles. Selected parameters were plotted versus depth in real time on screen and plotter (HP74-75A). The ZAPS was tied up on to the frame of the CTD-Rosette and connected to the CTD in place of the O_2 sensor according to the specifications given by OSU and supplies provided by Seabird Corp. O_2 probe was connected only when ZAPS sensor was not associated to the package.

Operations

The CTD-Rosette was deployed by using the A-frame on the fan tail of the AII with the very efficient help of Skip Gleason (WHOI) in charge of the cable unit. Because of the motion of the ship, weight was added to the frame of the CTD-Rosette to facilitate wiring out during the first 100 or 200 meters of the lowerings.

30 vertical hydrocasts were made during the **first leg**, including one short test lowering on our way from Woods Hole to the MAR. **12 lowerings** were made during the **second leg**, including 4, without sampling, only for hydrographic experiment (an operation in collaboration with OSU and K. Speer, cf proposal). Generally, all these operations worked well, with almost no trouble in cable connections and in data transmission.

The CTD itself worked perfectly well, but the nephelometer (Prieur type) was a subject of concern. Down to 200 m depth, the normal surface nephel signal was recorded, but no nephel signal was detected in deep waters: when reaching the baseline, we observed that this baseline was gently fluctuating (not a high frequency noise). We are not positive at this point whether the nephelometer was not functioning, or whether it did not have the sensitivity to record the relatively small transmissometer and nephelometer signals recorded by the OSU equipment.

Some of the lowerings were made by rough or very rough weather. Lowering, wiring out the first hundred meters and recovery were delicate operations for Hydrocast HY37 and HY40. For HY37, the CTD-Rosette came back with two bottles no more tied on the frame and just retained by a rope, damaging the valves of the nearby bottles. For HY40, two bottles were lost. The tying system of the bottles on the frame has to be revisited, but we probably run these hydrocasts close to the acceptable limits of running CTD's in rough sea conditions. This was also true for recovering the samples from the bottles on the fan tail.

Each hydrocast was sampled for Mn, CH_4, O_2 and silica. Some bottles, generally three, were sampled for J. Lupton (NOAA-PMEL) for Helium measurements (a total of 125 samples). Dissolved oxygen was analysed on board to check the depth where the bottles were fired by comparison to O_2 Atlantic vertical profiles. These measurements were done by using the potentiometric Winkler method (Metrohm equipment provided by IFREMER). Silica concentration will be measured on shore, for the same purpose, when back at Brest. From shipboard O_2 measurements, all bottles worked well.

Concerning hydrothermal tracers, Mn and CH_4 concentrations will be determined at IFREMER in Brest and He concentrations and isotopic ratios will be measured at NOAA-

PMEL. This will represent about **600 determinations of Mn and methane**. Some samples were also taken by OSU team for rare earth measurements (HY42).

During the second leg, the French team sampled the SLED Rosette (SLED 25, 26, 27, 39).

Preliminary results

In the absence of nephelometer signal, the two geochemical tracers of hydrothermal activity in deep waters, CH_4 and Mn (Total Dissolvable Manganese), will be available from onshore measurements, when the cruise is completed: see OSU report for the Mn-ZAPS sensor results. Potential temperature anomalies and density anomalies in the water column, available during the cruise, cannot be considered as a straight forward indication of hydrothermal activity; they can be related to water masses, which is obviously the case for the upper 1000 to 1200 meters and which also may be the case when these anomalies are associated with major relief discontinuities on the seafloor such as the discontinuity between the rift valley and the top of the rift mountains. We have to note that, in any case, the outputs which are related to ultramafics outcrops are thought to be associated with low temperature diffuse discharges and that no nephel signal has been observed so far: this last property is in agreement with the low Mn concentrations (as well as probably Fe) found to be associated with high CH_4 anomalies in seawater for this type of output. As a consequence, no physical anomalies and very low Mn signals are to be expected in this case.

These statements being made, there are ridge segments where no temperature anomaly at all is visible and segments where anomalies do exist. The amplitude of these anomalies (up to 1/10 of a degree) are not big enough to be seen as the data are recorded: the temperature is plotted in real time versus depth in a range from 0 to 30°C to cover the entire spectrum of temperature variation during the lowering. The data have to be processed and potential temperature, density salinity plots have to be made to identify possible anomalies or deviations from the normal correlations between these parameters. Such anomalies are well known, i.e. on the EPR at 13°N (Charlou et al., *Deep Sea Res., 38, 5,* 569-596, 1991), on the Endeavour segment of the Juan de Fuca Ridge (Lupton et al., *Nature, 316, 6029*, 621-623, 1985) or in the Lau back-arc basin (Fouquet et al., *Geology, 19*, 303-306, 1991). Some salinity and density profiles reveal the existence of the effluent layer: the top of the layer coincides with a pronounced hump in the salinity and the variation of density with depth within the layer is much smaller than above or below, indicating low stability. Examples are given in figures 1 and 2 for hydrocasts HY-11 and HY-22 (FAMOUS area). Figures 1a and 2a show vertical profiles of temperature, salinity and potential density (sigma-2) versus depth, 800 m above the seafloor. Figures 1b and 2b represent T/S diagrams and potential temperature versus density (sigma-2). On these plots, the relationships between potential temperature/salinity and between potential temperature/density are represented by straight lines in absence of hydrothermal inputs (Fig. 1b). Deviation from straight lines are observed in figure 2b and can represent hydrothermal signals. In this case, the effluent layer produced a marked excursion from the linear mixing trend with holds for ambient water masses unaffected by hydrothermal input.

Temperature-density/salinity anomalies were observed in hydrocasts HY-24 and HY-25, located respectively 5 miles south and just over the "Lucky Strike" hydrothermal site which was discovered by dredge DR15 (sulfides and living mussels). There is no relief discontinuity at the depth where these anomalies are recorded. This temperature anomaly lies between 1400 and 1700 m depth, which is within the 300m above the Lucky Stike site discovered by DR15 (1770 m), the altitude where generally hydrothermal plumes develop. We can be fairly confident that these anomalies reflect the presence of hydrothermal activity at the "Lucky Strike" site.

Similar temperature-density/salinity anomalies were also observed on the FAMOUS segment (HY-22 at 36°45N, Fig. 2a-2b, and HY-21 at 36°37N), whereas in the northern part of this segment HY 41 displays almost no signal. No anomaly is seen from HY 20 on the AMAR segment. Temperature-density anomalies are well visible on the first segment studied during the cruise, the segment located immediately south of Hayes Fracture Zone. There is no relief discontinuity at the depth where all these anomalies are seen: they may well reflect hydrothermal activity in some areas along these segments.

Temperature-density/salinity anomalies are also observed on the central high of the segment located south of Oceanographer F.Z. (HY 13): the seafloor is at 2200 m and the anomaly sits at 1800 m. This depth coincides in this case (1700 m) with the rift mountains / rift valley discontinuity. The possibility of hydrothermal sites at this location must be confirmed by other parameters.

Anomalies are also observed in the area of the Azores Triple junction, but lying in the upper 1200 m. No statement can be made from temperature-density/salinity data for a possible relationship with hydrothermal activity in this later case.

These preliminary results have to be considered as indications on hydrothermal activity on some segments. Results, more directly related to hydrothermal activity, either for hot hydrothermal discharges located on zero-age neovolcanic ridges or for possible diffuse discharges from ultramafic outcrops on the rift valley walls, will be available onshore from Mn and CH_4 measurements.

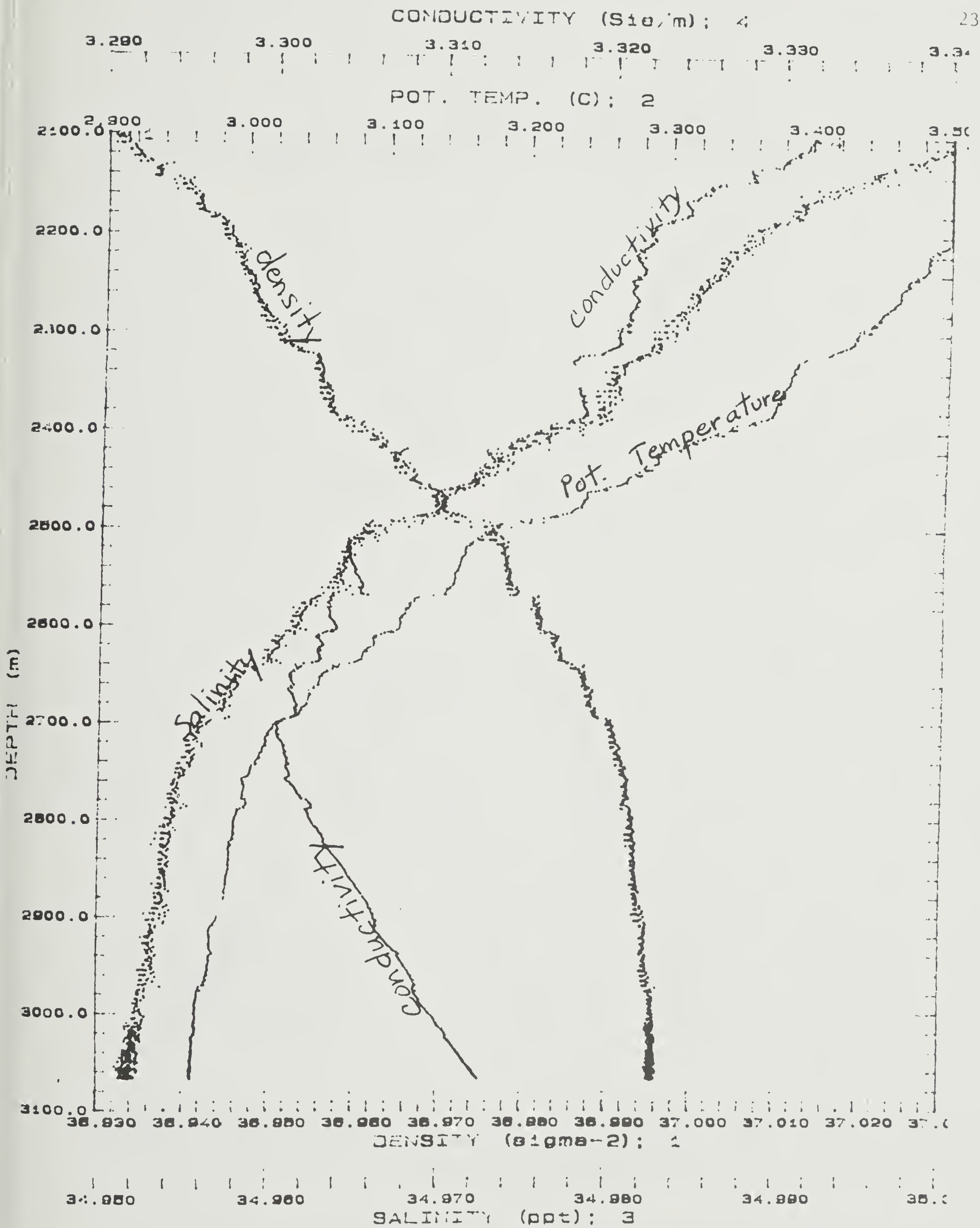


Figure 3. HY 11, plots of physical parameters versus depth (density, conductivity, salinity) and Potential Temperature versus depth.

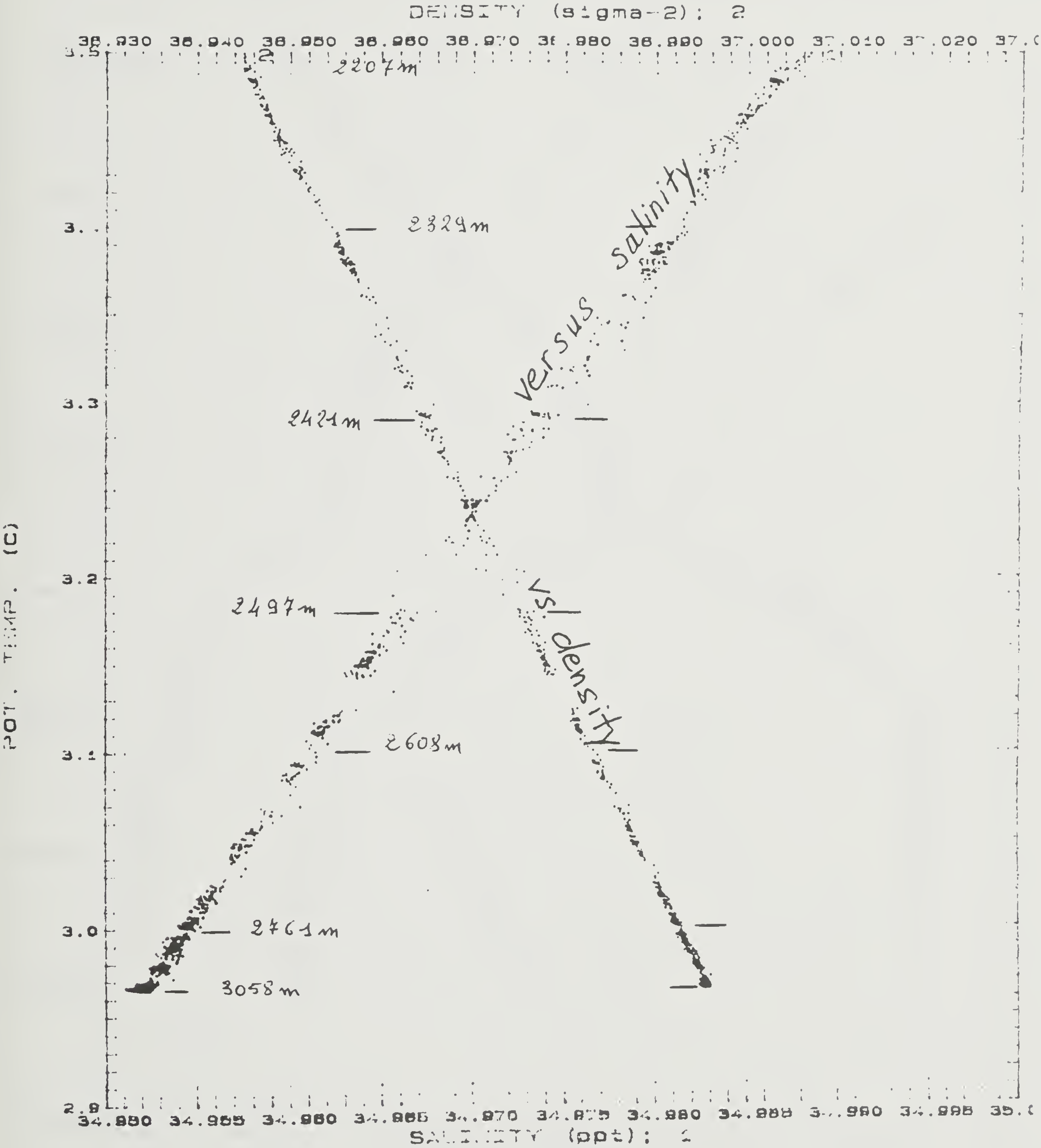


Figure 4. HY 11, plots of Potential Temperature and of density versus salinity. HY 11 is an example where no anomaly is observed on these plots, despite many discontinuities observed in Figure 3.

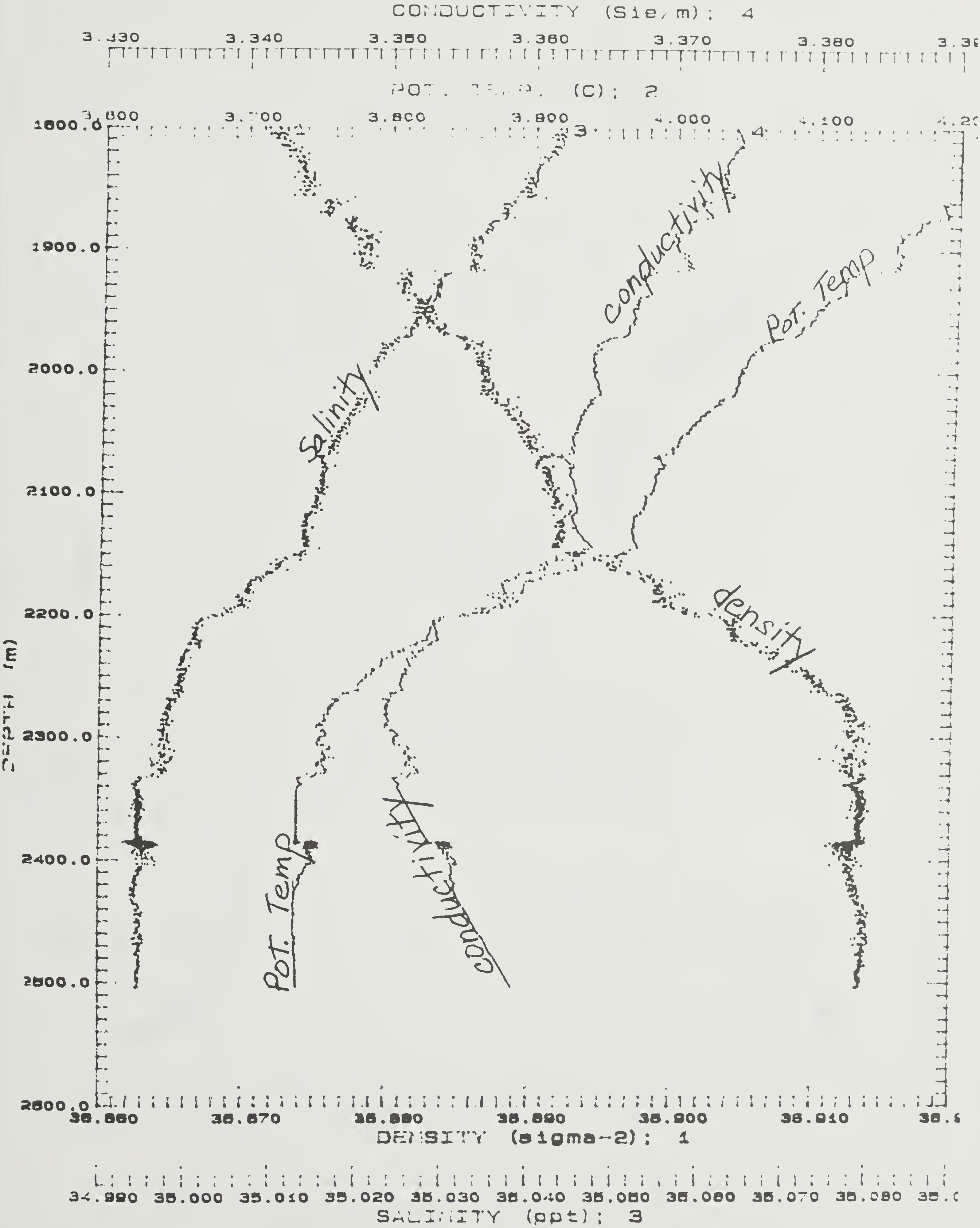


Figure 5. HY 22, in the FAMOUS area, plots of physical parameters versus depth (density, conductivity, salinity and Potential Temperature versus depth).

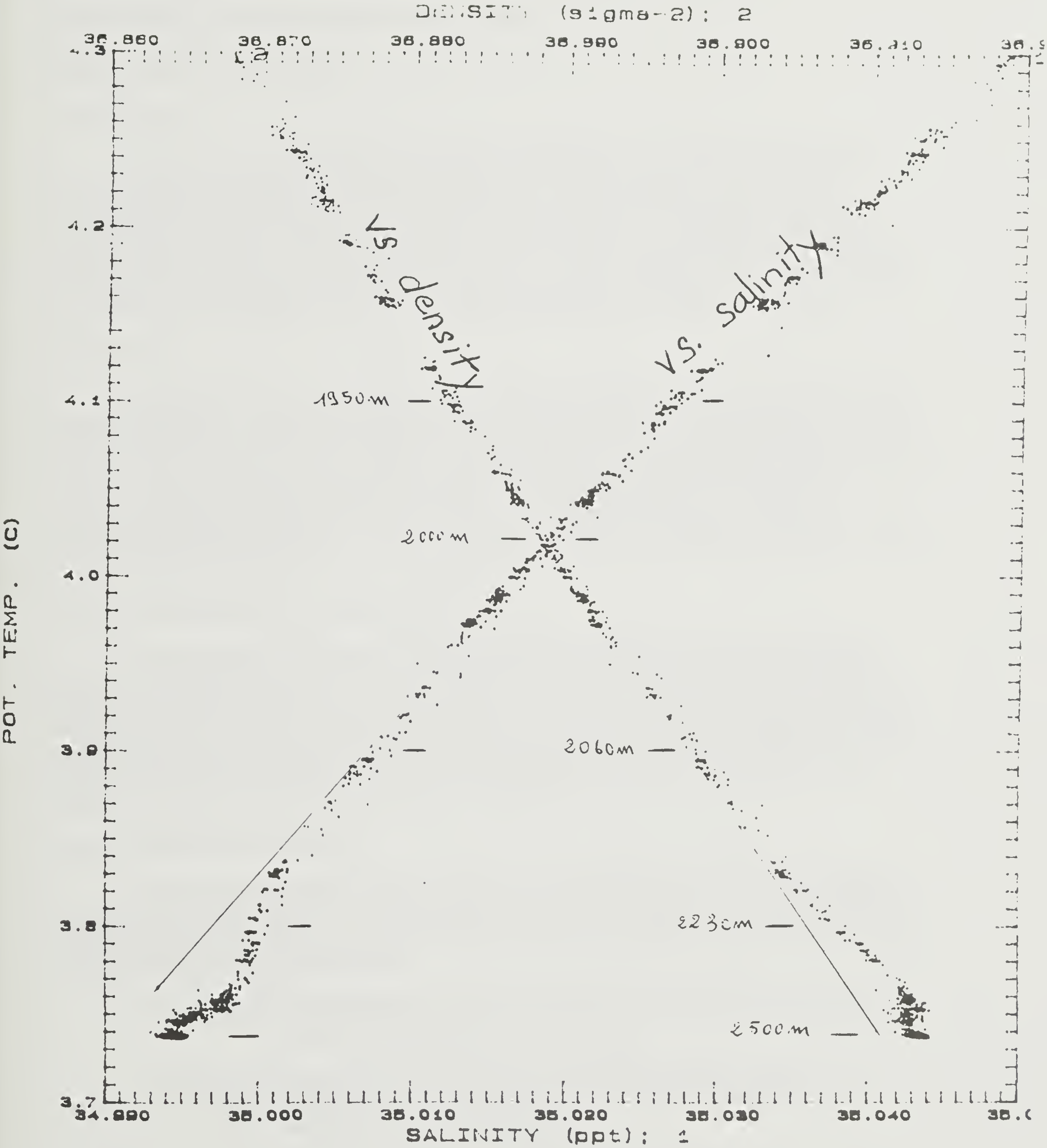


Figure 6. HY 22, plots of Potential Temperature and of density versus salinity. HY 22 is an example of a well developed anomaly between 2500 and 2200 m depth.

ZAPS DEPLOYMENTS AND SLED OPERATIONS

ZAPS Sled Towed Vehicle

Introduction

Venting of hot, chemically-rich, buoyant fluids from mid-ocean ridge spreading centers produces hydrothermal plumes with distinct thermal, physical, and chemical signatures quite different from background bottom sea water. These plumes rise several hundred meters above the seafloor where they reach buoyancy equilibrium and begin to spread laterally. We have designed and constructed a towed vehicle, the ZAPS sled, with in situ sensors. This vehicle was used as a survey tool to detect plumes in the FARA area and then determine their areal extents in a few chosen segments by towing at 1 - 2 knots.

Sled Frame

The ZAPS Sled towed vehicle (Figure 7) is an open framework of 2 inch Type 316 Stainless Steel pipe. It stands 36 inches wide, 36 inches tall, and is 7 feet long with a tapered bow 16 inches wide. This frame hangs from the towing cable by an adjustable three point chain bridle to ensure that the sled attains a forward facing, level attitude in the water. The two vertical sides of the sled aft of its center of gravity have three-eighths inch Lexan polycarbonate panels attached to serve as rudder vanes and give the structure hydrodynamic stability while being towed at 1 - 2 knots through the water. The weight of the frame in air is approximately 800 pounds.

Conducting Cable and Traction Winch

The monitoring instruments on the sled transmitted data to the ship via a standard UNOLS 0.680 inch diameter coaxial conducting cable with an armored sheath and rated to 20,000 lbs. breaking strength. Ten thousand meters of cable were spooled onto a Dynacon Storage/ Traction Winch with diesel/hydraulic drive capable of wire speeds greater than 100 meters/minute and loads in excess of 10,000 pounds. Woods Hole Oceanographic Institution supplied the winch especially for this cruise and it performed flawlessly thanks to Skip Gleason, the research technician aboard the Atlantis II.

ZAPS Sled Instrumentation

The central instrument on board the sled was a Sea-Bird 9/11 Plus CTD sampling at 24 Hz and fitted with modular temperature and conductivity sensors and a Paroscientific Digiquartz Pressure Sensor. Four analog instruments were interfaced through the Sea-Bird CTD underwater unit. These include:

1) A Sea Tech Transmissometer to measure 660 nm wavelength beam transmission through a 25 centimeter seawater path.

2) A Chelsea Aquatracka Mk III Fluorometer operating as a nephelometer at a wavelength of 420 nm to measure the backscattered light at 90 degrees to the incident light beam.

3) A Zero Angle Photon Spectrometer (ZAPS) which uses solid-state chemistry with flourescence signal detection to measure the concentration of dissolved manganese in sea water.

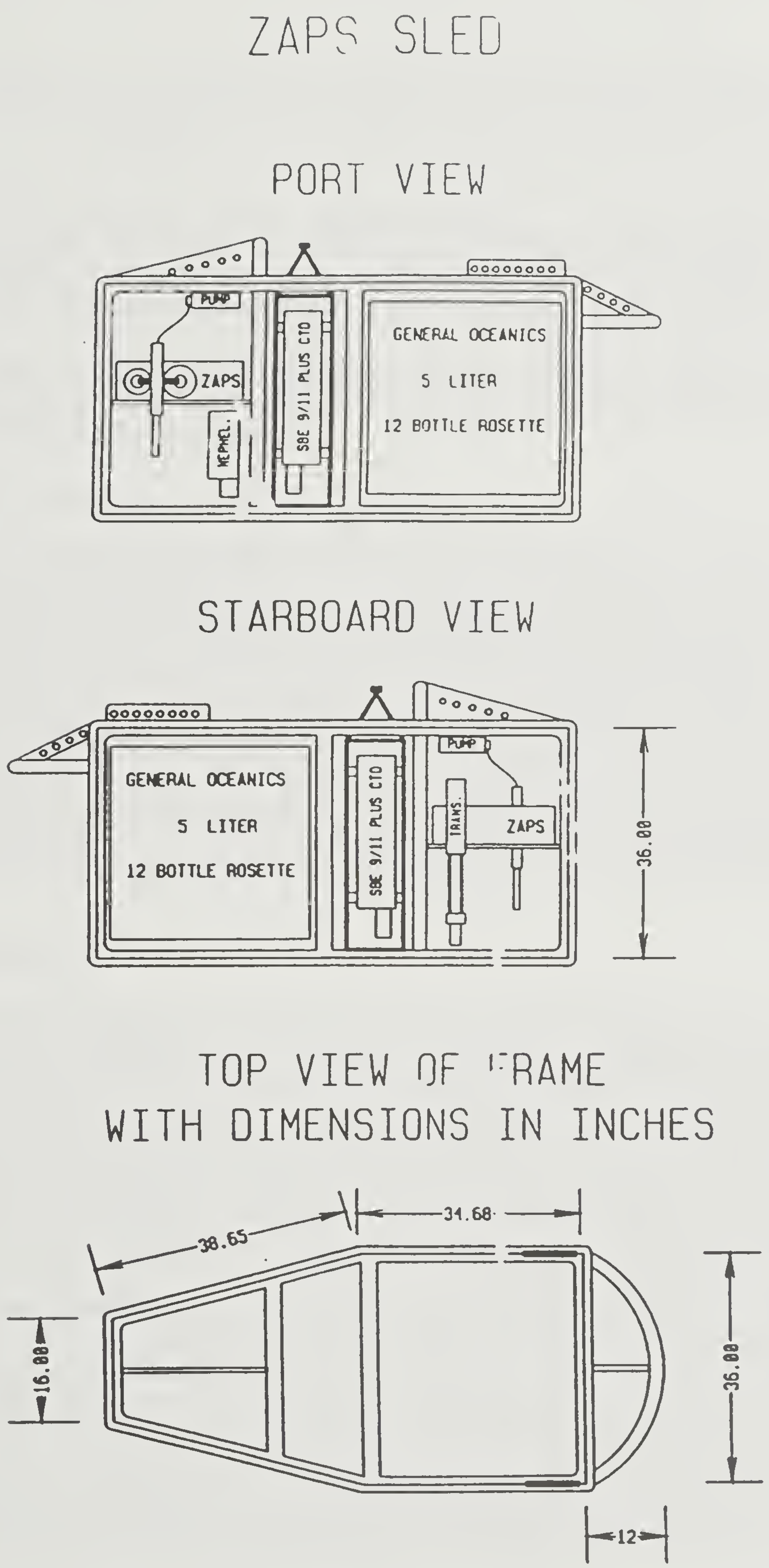

ZAPS SLED
PORT VIEW
PUMP
ZAPS
NEPHEL.
SBE 9/11 PLUS CTD
GENERAL OCEANICS
5 LITER
12 BOTTLE ROSETTE
STARBOARD VIEW
GENERAL OCEANICS
5 LITER
12 BOTTLE ROSETTE
SBE 9/11 PLUS CTD
PUMP
TRANS.
ZAPS
36.00
TOP VIEW OF FRAME
WITH DIMENSIONS IN INCHES
38.65
34.68
16.00
36.00
12

Figure 7

4) A SIMRAD Mesotech Systems Model 807 Echo Sounder / Altimeter to determine the towed sled height off the bottom within a 500 meter range.

The ZAPS sled also carried a General Oceanics Rosette array interfaced to the CTD and capable of holding twelve 5-liter Niskin sample bottles for collecting seawater samples for laboratory measurements such as methane, helium, and trace metals. The bottles can be tripped by signals from the CTD deck unit at any time without interrupting the data collection.

In addition, an acoustic transponder on the sled was interrogated through a hull-mounted transducer in order to determine the direct slant range and computed horizontal range to the sled while it was being towed.

Navigational System

A Garmin MRN 100 GPS Satellite Receiver was interfaced to a Silicon Valley 486 computer running a proprietary SLED navigation program developed at OSU. This navigation computer also received depth input from the CTD and direct acoustic slant range from an EG&G 8011A deck unit interrogating an acoustic transponder on the towed sled. The computer plotted in real time the ship's position and trackline and the computed horizontal range and position of the sled as projected onto the trackline of the ship. The navigation program also showed a diagrammatic cross-sectional view of the ship, the towed sled and a calculated "bottom depth" derived from the sum of the CTD pressure data and the concurrent altimeter data (height above bottom) from the towed sled. This calculated bottom depth beneath the sled could then be compared to the onboard ship's depth records and/or bathymetric maps of the area to help in locating the sled with respect to bottom features or obstacles.

Field Performance

The reverse polarity General Oceanics Rosette and the SIMRAD Mesotech altimeter gave us problems. The Sea-Bird 9/11 Plus underwater unit was designed to supply 15 VDC @ 1 Amp for all of the four interfaced instruments and the rosette. Initially, the Sea-Bird CTD - G/O Rosette system would not fire bottles. The voltages induced by enabling and triggering a bottle firing sequence introduced massive voltage spikes into the 0 - 5 VDC data streams of the other interfaced instruments, most notably the nephelometer and the ZAPS - the two instruments that drew the highest amperage. These conditions persisted even after the replacement of a faulty rosette cable. Eventually, it was discovered that the SIMRAD Mesotech altimeter drew more than 3 Amps every 1.33 seconds during its 250 microsecond transmit cycle thus exceeding the rating of the Sea Bird power supply during these times. We disconnected the altimeter, replaced the rosette electronic module, and disconnected a rosette case grounding lug in the reverse polarity rosette module. These changes finally allowed us to successfully enable and fire rosette water bottles, but we never managed to get any confirmation signals through to the CTD deck unit that the bottles had actually fired. Only upon recovery did we know that the bottles had actually closed. Even then spurious confirmation signals were received topside that had nothing to do with the bottle firing sequence. There still seemed to be some faulty grounding loop or feedback at work that we did not fully understand. This problem persisted until the end of the cruise.

As noted earlier, the SIMRAD Mesotech altimeter was disconnected for all of Leg 2 and removed from the sled. Removing the altimeter from the system virtually eliminated the voltage spike problems in the other instruments.

The Sea Tech transmissometer gave reliable and consistent results.

The Chelsea nephelometer seemed to have a high noise background signal that frequently (but not always) increased with time during any one lowering or tow. The signal from the nephelometer often coincided with a mirror-image deviation in the transmissometer signal. Contrary to theory however, the nephelometer did not seem to be as sensitive to plume particles as the transmissometer.

The conductivity, temperature, and pressure sensors connected to the Sea-Bird 9/11 Plus CTD worked consistently and reliably. When the French SeaBird CTD and the ZAPS sled CTD were used to profile at the same station within hours of each other, profiles of temperature and conductivity from the two units were virtually identical.

The ZAPS instrument produced a 20 mV signal during shipboard calibrations but ZAPS traces during deployments were considerably noisier. Several parameters were identified during the cruise that contributed to these noise problems. First it became clear that voltage spikes from the SIMRAD Altimeter and GO Rosette created instabilities in the ZAPS output during all sled lowerings in Leg 1. In addition various pump arrangements for ZAPS were tried during the cruise, none of these configurations proved to be completely satisfactory. Deployments of ZAPS on the IFREMER rosette system also proved troublesome. It turned out that the French CTD unit used a different voltage scale for analog output than the SeaBird CTD on the OSU sled. This voltage-offset problem resulted in several ZAPS profiles being "off-scale" during French rosette lowerings (see Table 5). However even with these "system" problems, ZAPS proved to be an extremely useful and sensitive instrument during FAZAR, capable of detecting vanishingly small signals.

Leg 1 Results

Introduction

The goals of the water column work on Leg 1 were twofold: firstly, to collect water samples systematically along this section of ridge, and secondly, to survey the water column for traces of hydrothermal activity. Water collection was accomplished with vertical lowerings of the IFREMER rosette system. This operation is discussed in another section of this report. The survey for hydrothermal activity involved deployments of ZAPS on the French rosette system with the IFREMER nephelometer, and OSU sled deployments.

ZAPS on the IFREMER Rosette

ZAPS was deployed with the rosette package 26 of the 30 times the French system was lowered during Leg 1. The following tabulation is a summary of ZAPS results for these hydrocast lowerings. (Table 5)

Table 5. ZAPS / Rosette Summary for Leg 1

Hydrocast	Segment	ZAPS (?)	Comments
A127-003-HY01	off-axis	no	test station
A127-004-HY02	off-axis	no	test station
A127-006-HY03	S. Hayes (R4)	yes	off-scale
A127-009-HY04	S. Hayes (R4)	yes	off-scale
A127-011-HY05	Major N. Hayes (R13A)	yes	no plume
A127-014-HY06	Minor N. Hayes (R13B)	yes	off-scale
A127-019-HY07	Major N. Hayes (R13A)	yes	no plume
A127-020-HY08	Central Segment (R12)	no	no data
A127-024-HY09	Central Segment (R12)	yes	off-scale
A127-032-HY10	Central Segment (R12)	yes	no plume
A127-033-HY11	Central Segment (R12)	yes	no plume
A127-035-HY12	S. Oceanographer (R11)	yes	possibly active
A127-042-HY13	S. Oceanographer (R11)	yes	off-scale
A127-043-HY14	S. Oceanographer (R11)	yes	possibly active
A127-048-HY15	N. Oceanographer (R10)	yes	plumes
A127-055-HY16	South Amar (R9B)	yes	no plume
A127-056-HY17	South Amar (R9B)	yes	no plume
A127-063-HY18	AMAR Minor (R9A)	yes	no plume
A127-064-HY19	AMAR (R8)	yes	plumes
A127-068-HY20	AMAR (R8)	yes	plumes
A127-071-HY21	FAMOUS (R7)	yes	possibly active
A127-074-HY22	FAMOUS (R7)	yes	possibly active
A127-087-HY23	N. FAMOUS (R6)	yes	no plume
A127-091-HY24	Lucky Strike (R5)	yes	plumes
A127-097-HY25	Lucky Strike (R5)	no	no ZAPS
A127-102-HY26	Rifted Mountain (R4)	yes	plumes
A127-107-HY27	Rifted Mountain (R4)	yes	plumes
A127-114-HY28	Twin Hills (R3)	yes	no plume
A127-117-HY29	Twin Hills (R3)	yes	no plume
A127-125-HY30	Azores (R2)	yes	no plume

As this table indicates, many of the lowerings carried out during the Leg 1 survey did not contain a significant hydrothermal signal. This result is what one would expect given the size of the survey area.

Figure 8 shows 24 Hz data from hydrocast #5 carried out in the Major N. Hayes segment and is an example of a ZAPS trace without a discernible Mn anomaly. To interpret this raw data it is necessary to know that ZAPS produces signals inversely related to the dissolved manganese concentration. Thus this profile shows Mn decreasing from a maximum in surface water to a more-or-less low and constant concentration in deep water. This trace corresponds to a surface concentration of about 2.0 nmol/kg and a deep water value of about 0.15 nmol/kg. While one might argue for an extremely small anomaly between 2300 and 2800 meters, there is no distinct hydrothermal signal here and this segment is listed as "no plumes" in Table 5.

It is informative to compare the trace from N. Hayes with ZAPS results from HY15 in the North Oceanographer segment (Fig. 9). This profile shows Mn increasing below about 1800 meters with a clear step in concentration from 2300 to 2800 meters. This sharp gradient in manganese is indicative of hydrothermal injection. Another interesting feature of this trace is the positive manganese anomaly associated with T-S breaks between 800 and 1,000 meters.

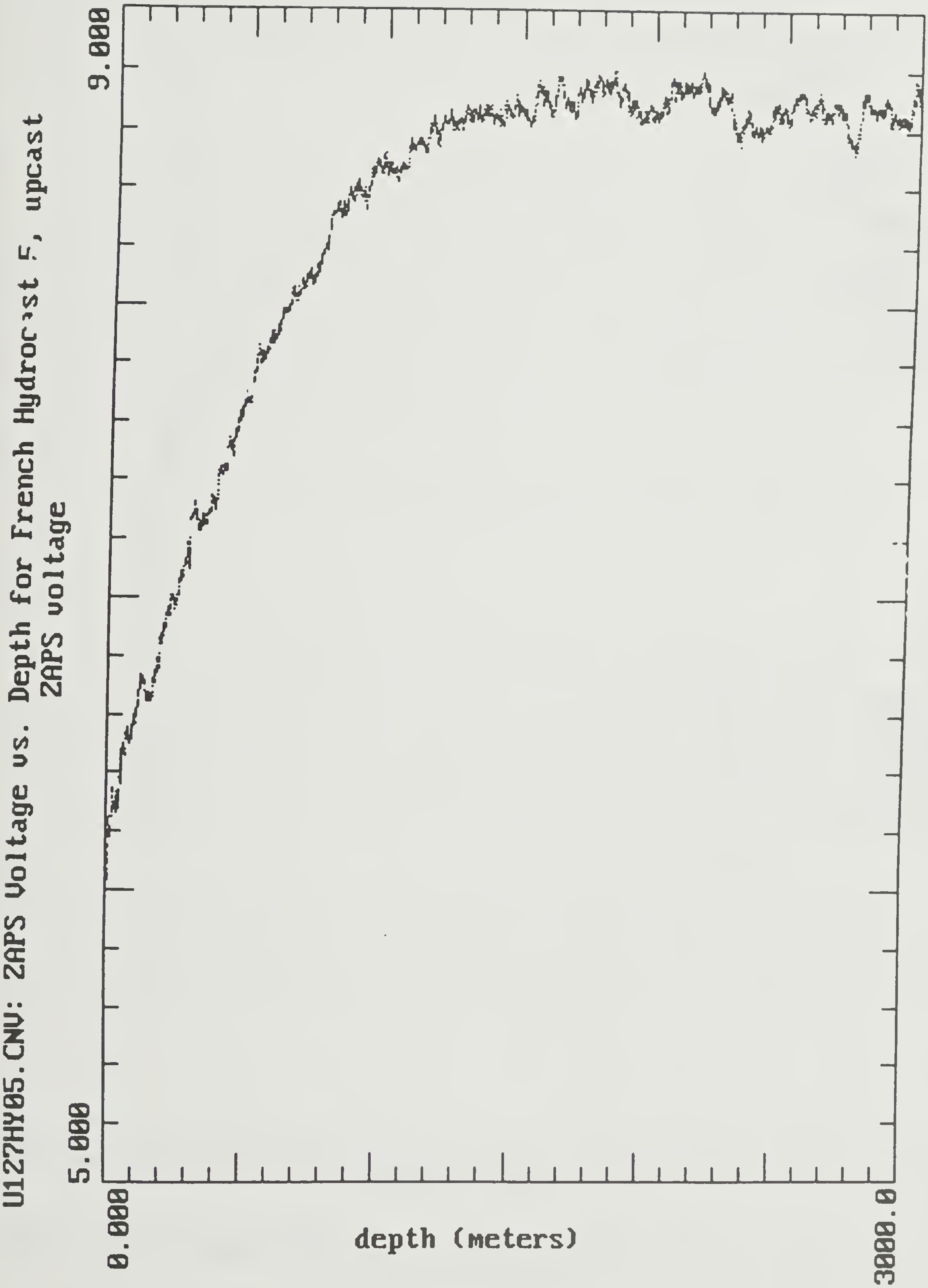

U127HY05.CNV: 2APS Voltage vs. Depth for French Hydrocast 5, upcast
2APS voltage
9.000
5.000
0.000
3000.0
depth (meters)

Figure 8

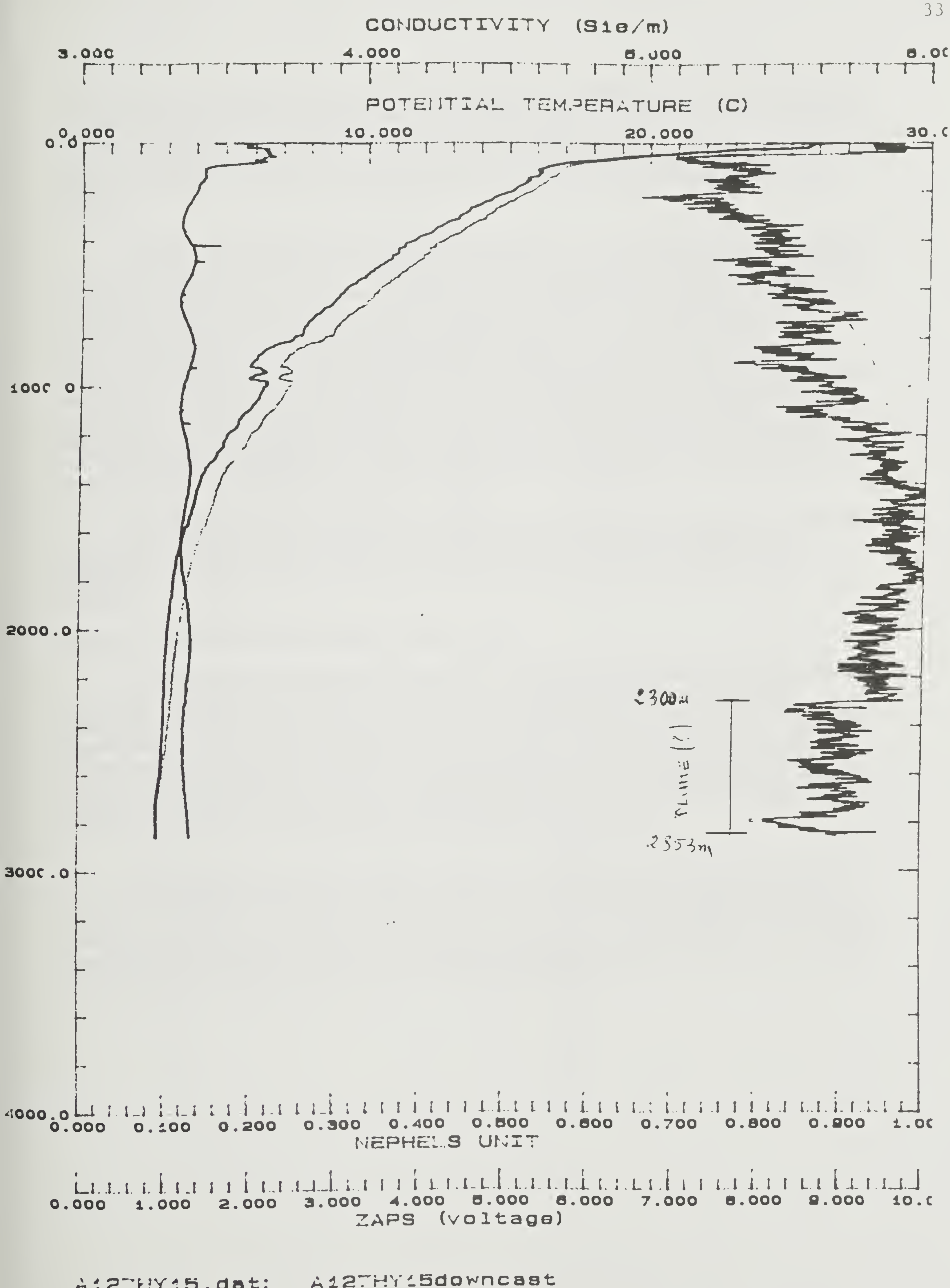

CONDUCTIVITY (Sie/m)
4.000
POTENTIAL TEMPERATURE (C)
10.000
20.000
1000.0
2000.0
3000.0
2300m
2353m
0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900
NEPHELS UNIT
0.000 1.000 2.000 3.000 4.000 5.000 6.000 7.000 8.000 9.000
ZAPS (voltage)
A12THY15.dat: A12THY15downcast

Figure 9

These inflections mark the intrusion of Mediterranean water into this area. The ZAPS profile is consistent with previous observations of high manganese concentrations in Mediterranean outflow waters. This hydrographic feature in T-S-ZAPS depth profiles was repeated at several stations during FAZAR. While not related to hydrothermal activity on the MAR the ability of ZAPS to detect this anomaly lends credibility to hydrothermal signals deeper in the water column.

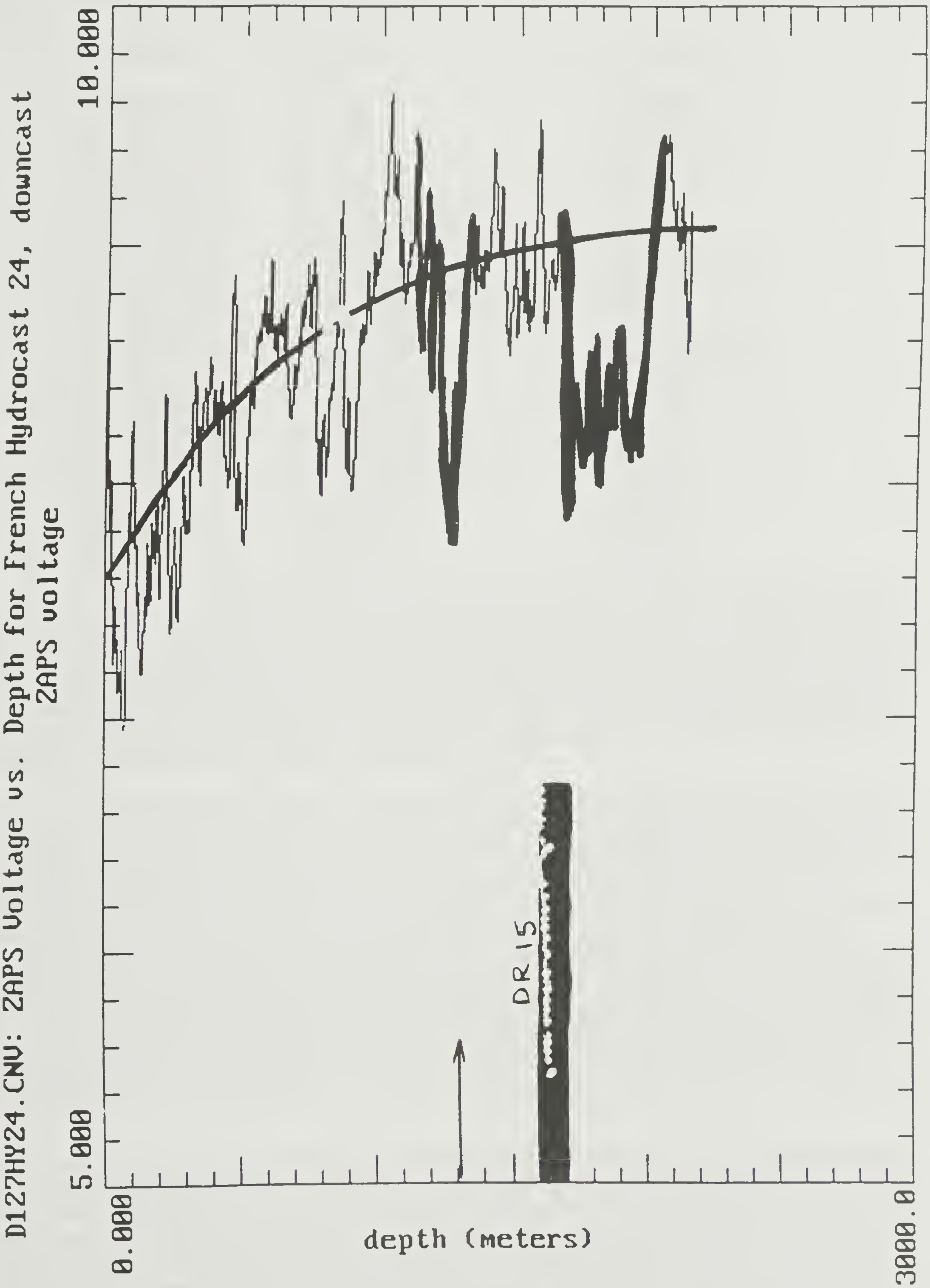
Perhaps the most rewarding ZAPS data from Leg 1 was obtained during a particularly noisy lowering of the ZAPS instrument during HY24 (Fig. 10). A quote from the ZAPS log recorded immediately after this cast describes "two possible plumes, one sharp minimum in voltage at 1300 m and a broader minimum centered on 1900 m." The operation following HY24 was dredge #15 which recovered a sulfide chimney from between 1600 and 1700 meters. Assuming such structures are conduits for buoyant fluids as has been observed elsewhere, then chimneys at these depths should produce plumes that reach neutral buoyancy between 1300 and 1400 meters, exactly the depth of the upper ZAPS anomaly observed in HY24. This "ground truth" substantiates once again the validity of using small distal plumes for hydrothermal exploration. The ZAPS trace from HY24 also contains a more complex anomaly centered on 1900 meters. This signal is consistent with the presence of another vent field in deeper areas of the Lucky Strike segment.

In summary, the ZAPS instrument detected distinct dissolved manganese anomalies in 4 of the 13 segments sampled with the IFREMER rosette during Leg 1. Results from FAMOUS were somewhat inconclusive, although no clear anomalies were seen in this segment.

Results From Sled Lowerings During Leg 1

Another tracer for hydrothermal activity is the presence of particle-rich layers above the seabed. As previous studies have shown and as born out by work on this cruise, dissolved manganese concentrations and suspended particles levels are not always redundant measurements. As one might expect particles and dissolved substances are easily fractionated in vent systems and, therefore, it is not surprising that some waters investigated during this cruise contained distinct Mn anomalies without significant particle anomalies (e.g. the upper anomaly in the Lucky Strike Segment as described below) and vice versa (increased particle concentrations with no coincident increase in dissolved manganese).

These observations point out the importance of deploying chemical sensors like ZAPS in the same package with particle sensing instruments. Unfortunately it was not possible to adhere to this scheme during rosette lowerings for this project as the IFREMER nephelometer was not functioning during FAZAR (at least in deep waters). This combination of instruments was available, however, during the 19 ZAPS sled deployments carried out during Leg 1. Sled runs from the first leg are summarized in the following Table 6.



D127HY24.CNV: 2APS Voltage vs. Depth for French Hydrocast 24, downcast
2APS voltage
10.000
5.000
0.000
3000.0
depth (meters)
DR 15

Figure 10

Table 6. ZAPS Sled Summary for Leg 1

Sled Station	Segment	Comments
A127-001-SL01	off-axis	test station
A127-002-SL02	off-axis	test station
A127-003-SL03	off-axis	test station
A127-004-SL04	off-axis	test station
A127-015-SL05	Major N. Hayes (R13A)	aborted
A127-015-SL06	Major N. Hayes (R13A)	no plumes
A127-049-SL07	N. Oceanographer (R10)	plumes
A127-052-SL08	N. Oceanographer (R10)	bottom anomaly
A127-060-SL09	South AMAR (R9B)	plumes
A127-067-SL10	AMAR (R8)	plumes
A127-076-SL11	FAMOUS (R7)	bottom anomaly
A127-077-SL12	FAMOUS (R7)	no plumes
A127-081-SL13	FAMOUS (R7)	no plumes
A127-095-SL14	Lucky Strike (R5)	plumes
A127-103-SL15	Rifted Mountain (R4)	plumes
A127-116-SL16	Twin Hills (R3)	no plumes
A127-130-SL17	Azores (R2)	no plumes
A127-133-SL18	Azores (R2)	no plumes
A127-138-SL19	Azores (R2)	no plumes

The Lucky Strike hydrothermal site was explored with the ZAPS system during sled tow #14. Fig. 11 shows a time slice from this lowering when the sled was towed across the summit of the axial volcano where the sulfide chimney was recovered during DR15. A distinct positive anomaly in dissolved manganese was recorded by ZAPS precisely over the dredge track and precisely at 1300 meters. Further analysis is required to determine the exact size of this anomaly but it is on the order of 2-3 nmol/kg. Interestingly, no nephel or transmittance anomalies were associated with this manganese signal.

More sled work was done at Lucky Strike during Leg 2 (Fig. 16) confirming these findings. No "large" TAG-like plume was detected at this site. Furthermore the upper plume appears to be manganese-rich and particle-poor while the deeper plume contains significant quantities of particles as well as manganese. These observations are consistent with the presence of an enormous "leaky" hydrothermal system at Lucky Strike. In this scenario the fluids exiting the summit are hot enough to produce sulfide structures (200-300°C) but substantially cooler than end-member fluids. Cooling is affected by seawater leaking into the roots of the system. Thus iron is titrated out sub-seafloor by oxygenated sea water, resulting in particle-poor fluids, with diluted fluids emanating from the summit. Alternately we simply missed a "large" TAG-like plume, or the end-member chemistry of vent fluids at Lucky Strike is distinctly different from other hydrothermal sites due to unusual basalt chemistry or pressure regimes. These questions will be answered by future exploration of the Lucky Strike segment.

We have discussed anomalies found with the ZAPS sled in the Lucky Strike segment. In addition to these discoveries, anomalous nephel and light transmittance signals were found in the South AMAR (Figs. 12 & 13) and AMAR (Figs. 14 & 15) segments during Leg 1. In both cases mirror-image traces from the Chelsea nephelometer and SeaTech Transmissometer support each other and clearly indicate the presence of hydrothermal plumes in these areas. Additional sled work was carried out in these segments during Leg 2 (see next section). Again the Leg 2 results confirmed our earlier findings, and narrowed down possible locations for the vent sites responsible for these plumes (see Figs. 16 & 17).

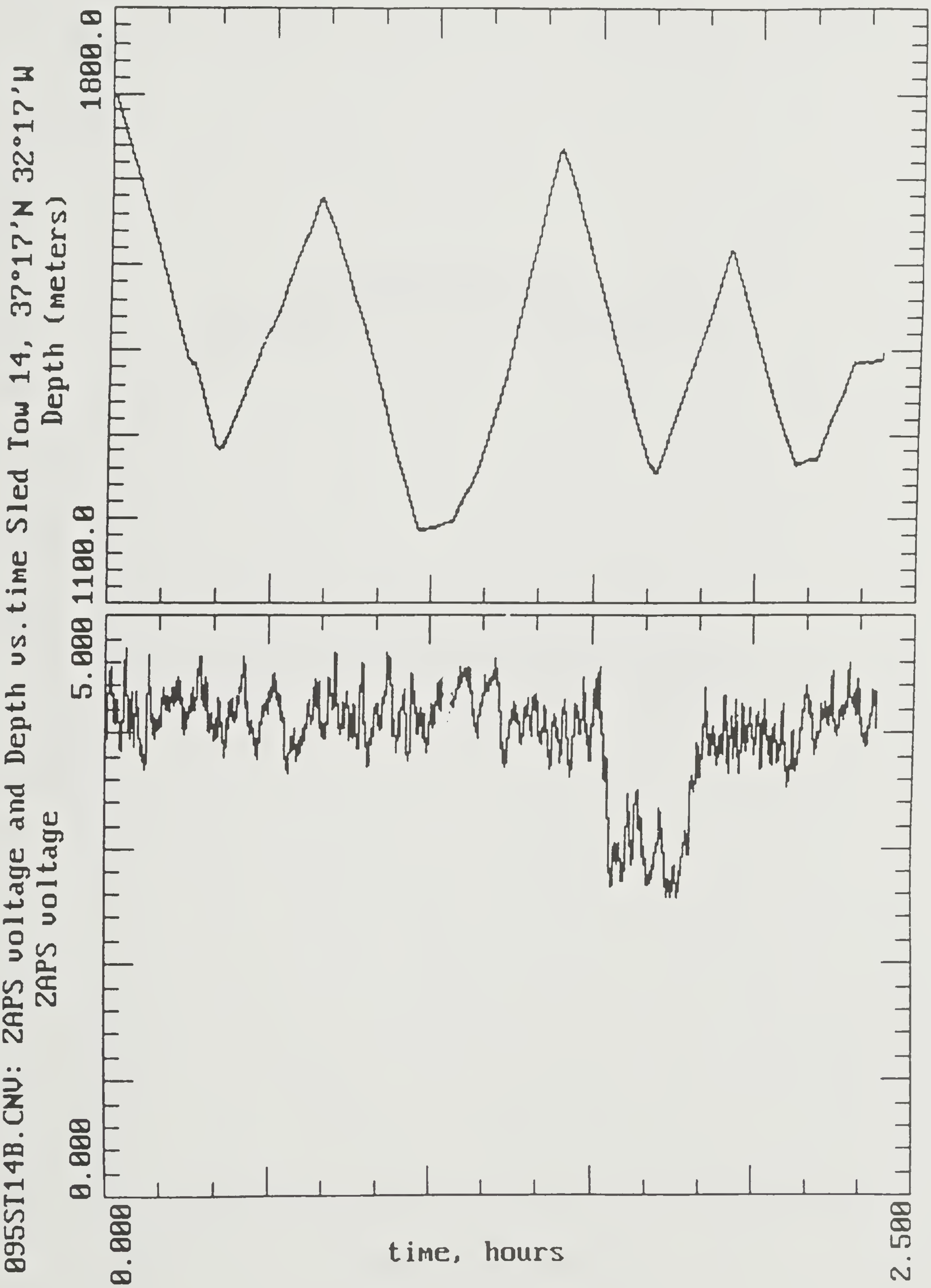

095ST14B.CNV: ZAPS voltage and Depth vs. time Sled Tow 14, 37°17'N 32°17'W
Depth (meters)
1800.0
1100.0
ZAPS voltage
5.000
0.000
0.000
2.500
time, hours

Figure 11

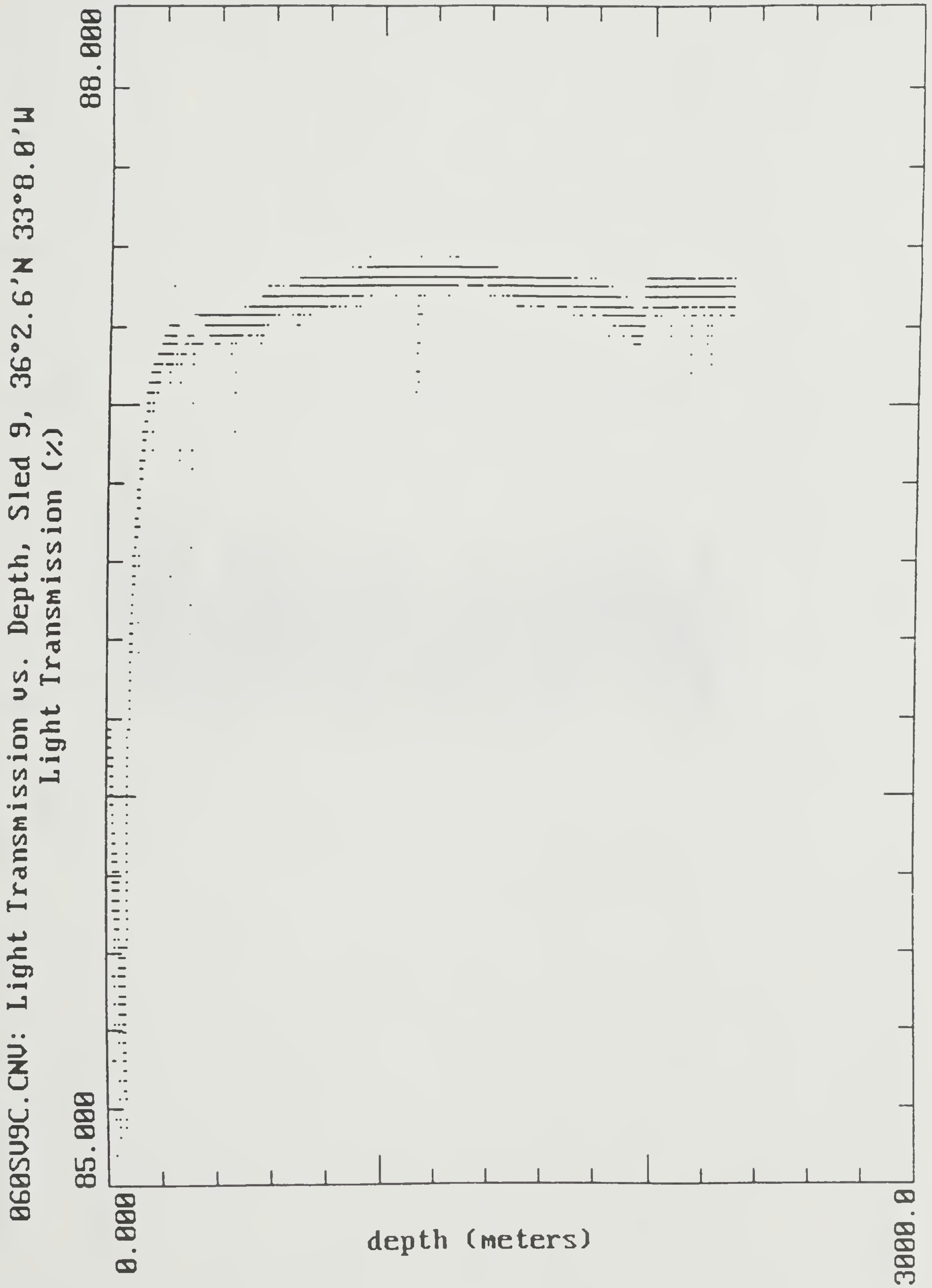

060SV9C.CNV: Light Transmission vs. Depth, Sled 9, 36°2.6'N 33°8.0'W
Light Transmission (%)
88.000
85.000
0.000
depth (meters)
3000.0

Figure 12

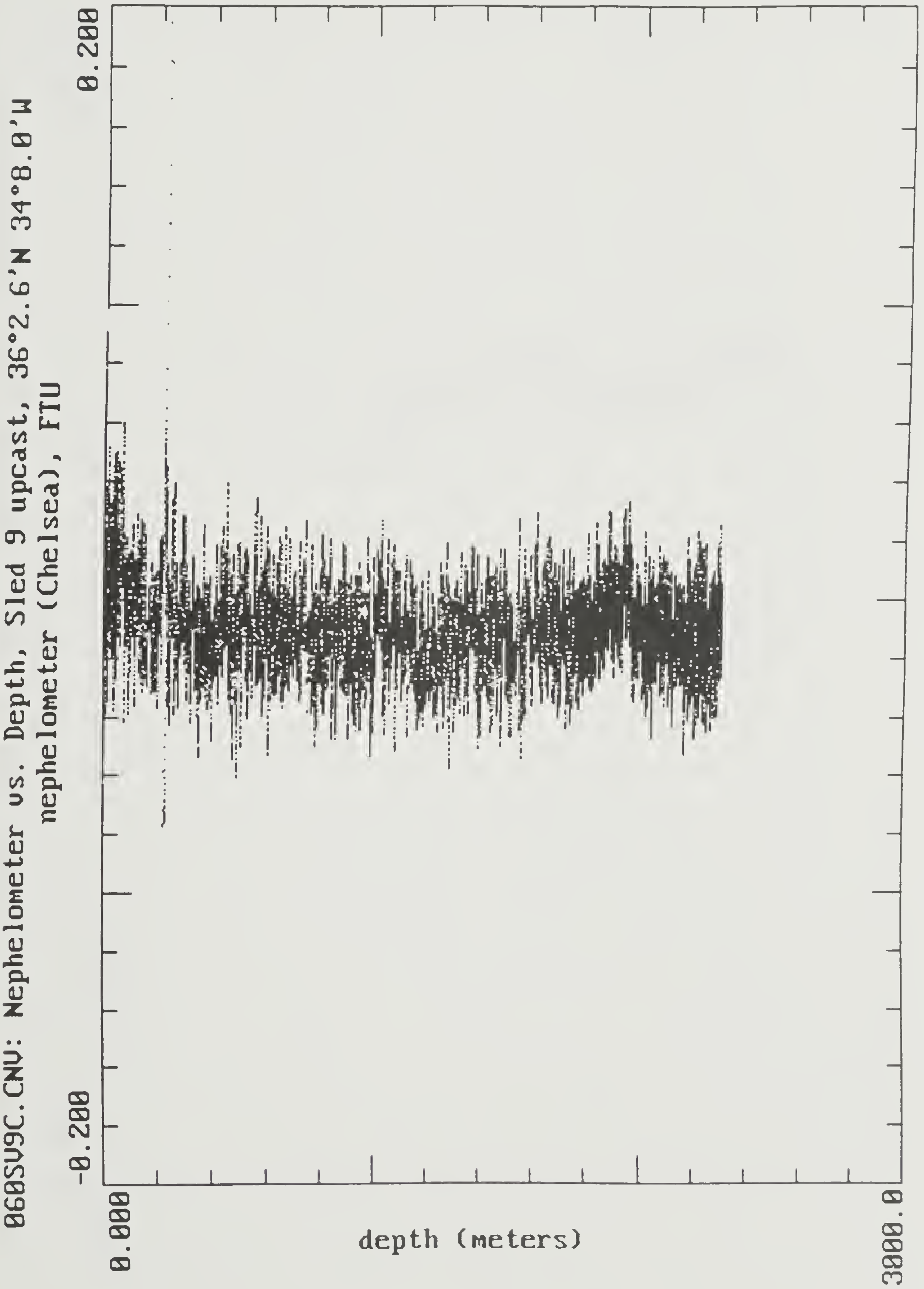

060SV9C.CNV: Nephelometer vs. Depth, Sled 9 upcast, 36°2.6'N 34°8.0'W
nephelometer (Chelsea), FTU
0.200
-0.200
0.000
depth (meters)
3000.0

Figure 13

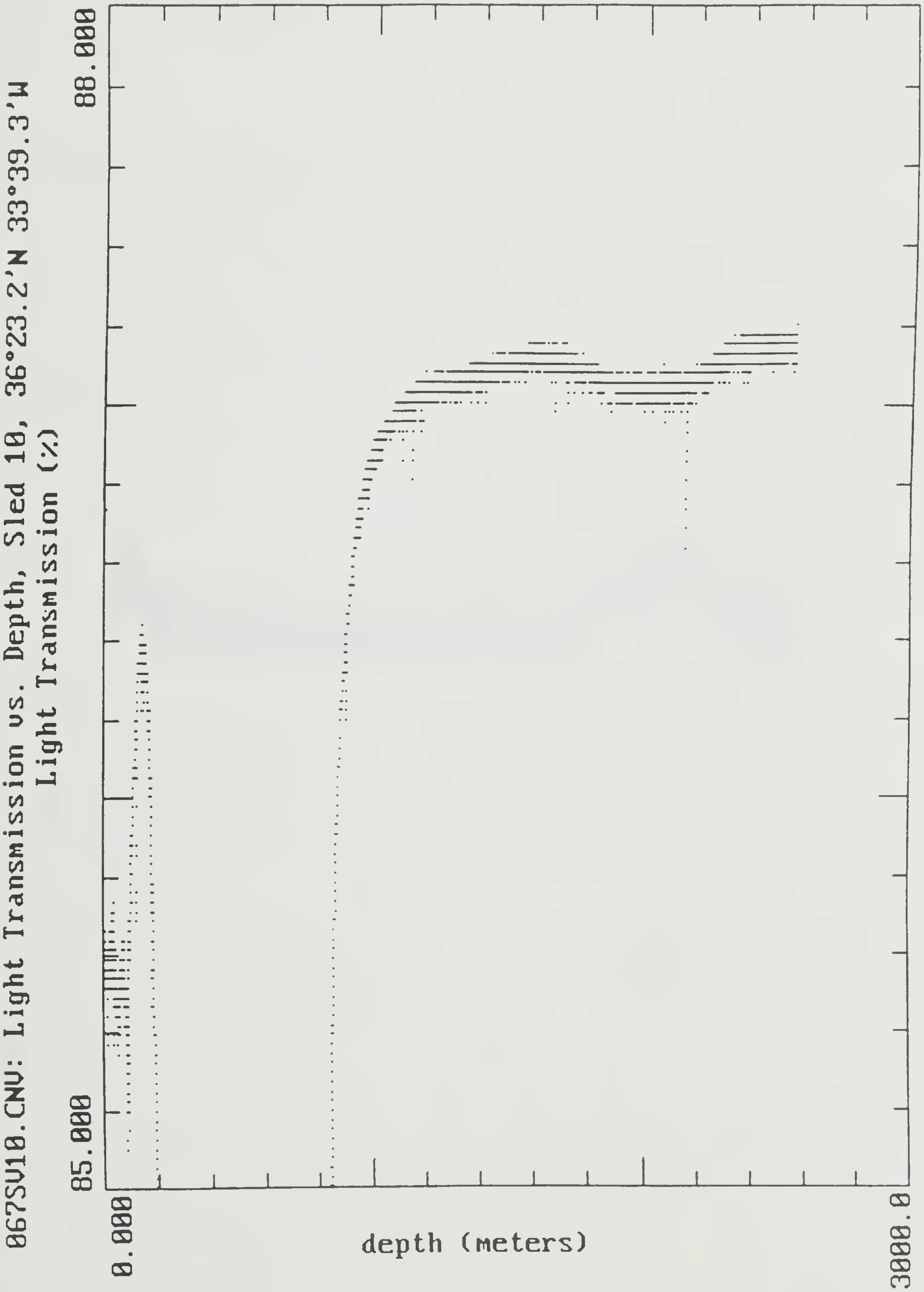

067SV10.CNV: Light Transmission vs. Depth, Sled 10, 36°23.2'N 33°39.3'W
Light Transmission (%)
88.000
85.000
0.000
3000.0
depth (meters)

Figure 14

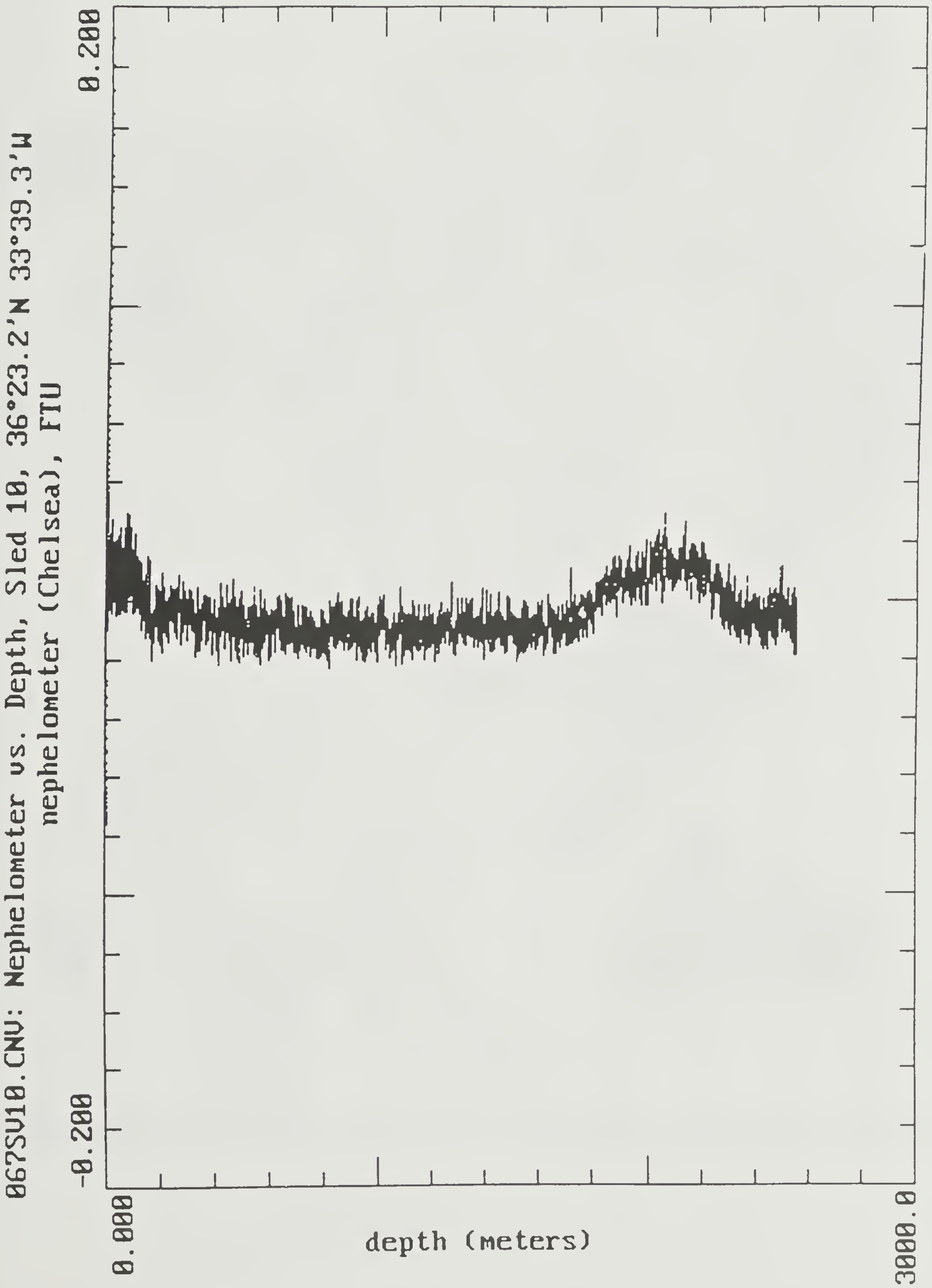
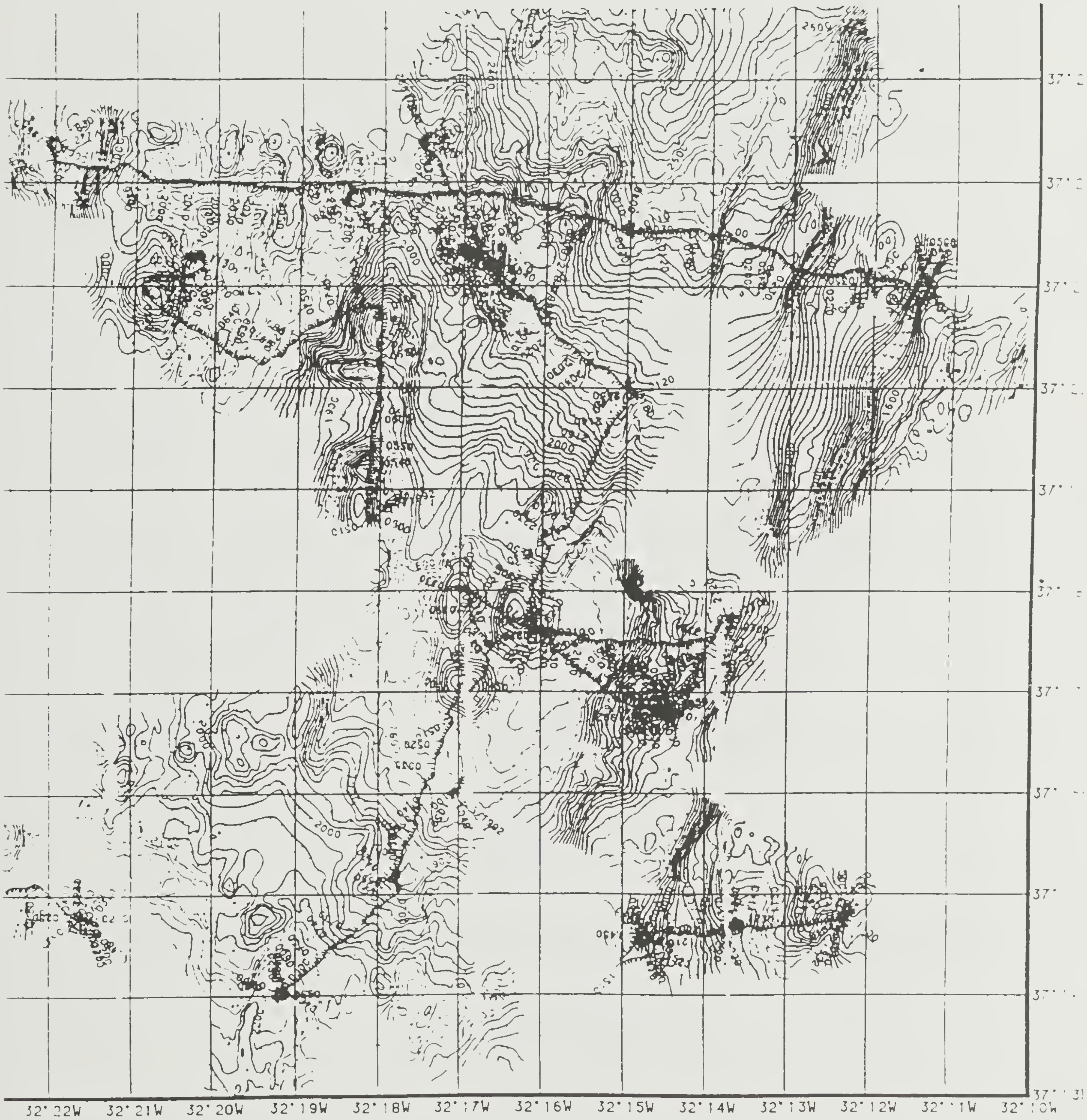
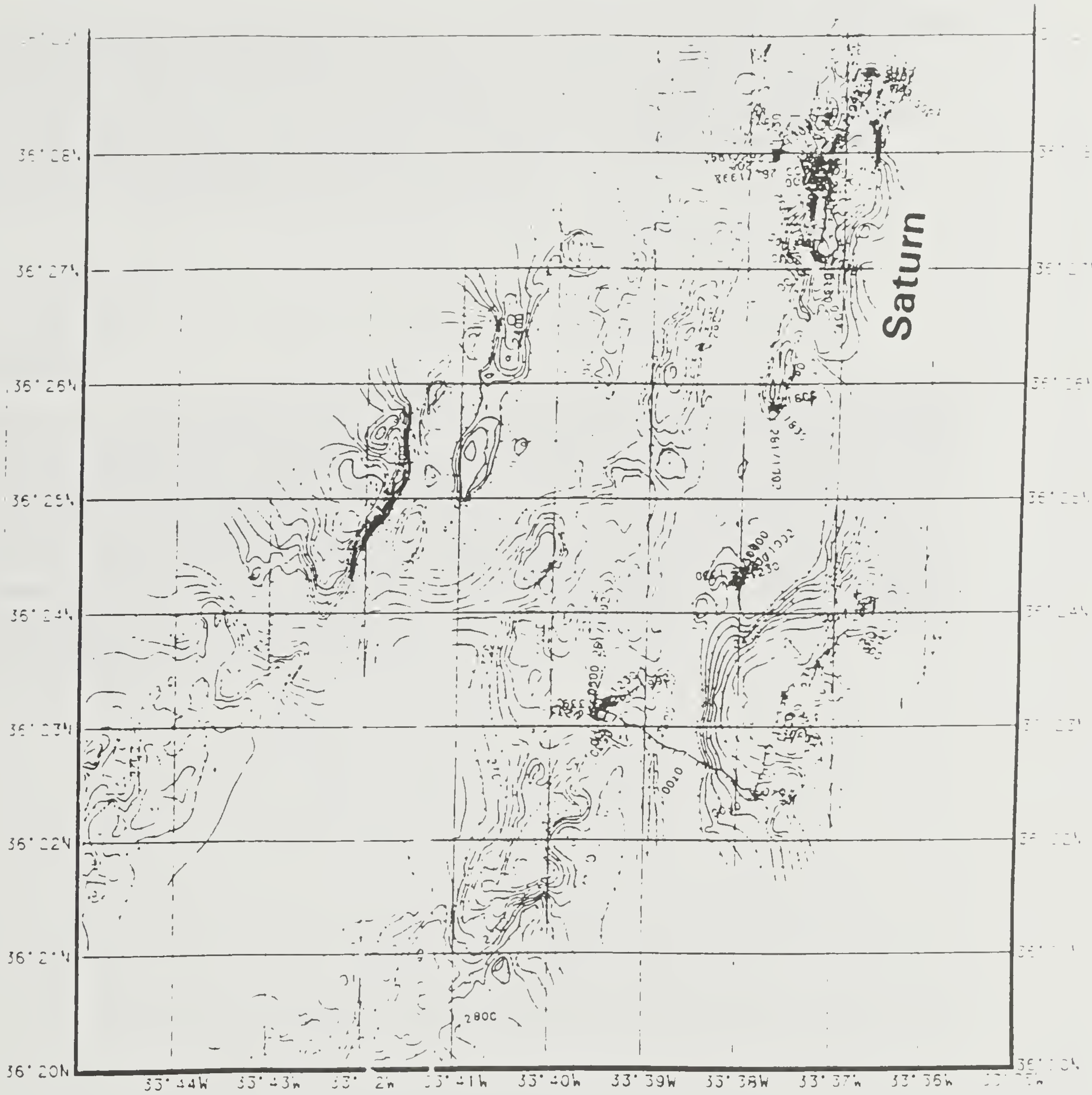

067SV10.CNV: Nephelometer vs. Depth, Sled 10, 36°23.2'N 33°39.3'W
nephelometer (Chelsea), FTU
0.200
-0.200
0.000
depth (meters)
3000.0

Figure 15



CRUISE A127L2
VENT AREA GRID
Oregon State University ZAPS sled
and French Hydrocast tows

Figure 16



CRUISES A127L1+L2
SOUTHERN AMAR AREA GRID
actual and calculated data

MERCATOR/WGS-84 - Scale 1:70995 at 036 00.000N

Figure 17

Leg 1 ended with 3 sled tows at the Azores Triple Junction. Twenty-six miles of trackline were logged during these tows and thus they represent a major effort to find evidence for hydrothermal activity in this highly magmatic area. Surprisingly, these tows did not produce any clear indications of hydrothermal activity. Transmissometer results from the summit of the large volcanic structure explored during ST17 were somewhat ambiguous because of the shallow depth and the local hydrography. Nevertheless, there was no consistent picture of hydrothermal activity in this area.

Leg 2 Results

Introduction

During Leg 2 a total of 28 ZAPS sled lowerings were completed in six segments of the MAR rift-valley. These lowerings represented 90.2 hours of sled deployment and data acquisition. Evidence for hydrothermal activity was confirmed in all but one of the six segments studied, and in this case (N. Oceanographer) the results were inconclusive. For the most part, sled operations during Leg 2 adhered to the strategy set out in the proposal. That is, the second pass over the section was used to further evaluate for hydrothermal activity those segments that looked promising based on Leg 1 results. The first week of Leg 2 was used to complete the regional survey from the Azores Plateau north to the Kurchatov FZ. Detailed surveys of individual segments began with our return to the Lucky Strike segment and therefore did not include much sled work.

Table 7. ZAPS Sled Summary for Leg 2

Sled Station	Segment	Comments
A127-142-SL20	South Kurchatov (R0)	plumes
A127-148-SL21	South Kurchatov (R0)	no plumes
A127-149-SL22	South Kurchatov (R0)	no plumes
A127-193-SL23	Lucky Strike (R5)	plumes
A127-196-SL24	Lucky Strike (R5)	plumes
A127-199-SL25	Lucky Strike (R5)	plumes
A127-202-SL26	Lucky Strike (R5)	plumes
A127-208-SL27	Lucky Strike (R5)	plumes
A127-213-SL28	Lucky Strike (R5)	aborted
A127-213-SL29	Lucky Strike (R5)	plumes
A127-215-SL30	Lucky Strike (R5)	plumes
A127-216-SL31	Lucky Strike (R5)	plumes
A127-234-SL32	Lucky Strike (R5)	aborted
A127-236-SL33	Lucky Strike (R5)	plumes
A127-237-SL34	AMAR (R8)	plumes
A127-241-SL35	AMAR (R8)	plumes
A127-242-SL36	AMAR (R8)	plumes
A127-243-SL37	AMAR (R8)	plumes
A127-244-SL38	AMAR (R8)	plumes
A127-247-SL39	AMAR (R8)	plumes
A127-249-SL40	AMAR (R8)	plumes
A127-253-SL41	AMAR (R8)	plumes
A127-255-SL42	AMAR Minor (R9A)	plumes
A127-256-SL43	South AMAR (R9B)	plumes
A127-269-SL44	N. Oceanographer (R10)	no plumes (shallow)
A127-274-SL45	N. Oceanographer (R10)	aborted
A127-281-SL46	S. Oceanographer (R11)	plumes
A127-287-SL47	S. Oceanographer (R11)	plumes

Deployments during Leg 2 were carried out from north of the Azores Triple Junction, at ~40°20'-40°30' N, to the segment immediately south of the Oceanographer Fracture Zone, at ~ 35° N. Of these, 6 towed sled lowerings (46.6 hours) were completed close to the Lucky Strike hydrothermal field at ~37° N and a further 9 sled lowerings (24.9 hours) were made at a second area of identified hydrothermal activity in the southern AMAR segment (~36°25' N). At the Lucky Strike field, ZAPS sled lowerings were complemented by a series of CTD hydrocast stations and Challenger Oceanics Stand-Alone Pump deployments. A single Stand-Alone Pump deployment was also carried out in the southern AMAR hydrothermal area.

Stations north of the Azores

Three sled lowerings (SL20-22) were completed north of the Azores, at latitudes 40°17' N - 40°28' N and in water depths of 2502-3034m. Only at the northernmost station (SL20, 40°28'N) was a slight hydrothermal plume signal observed, represented by a small (0.01 FTU) nephelometer maximum centered at ~2150m depth. There was no evidence for hydrothermal activity during the more southerly sled-lowerings, SL21 and SL22.

The Lucky Strike segment

Nine towed sled deployments (SL23-31) were completed at the Lucky Strike segment. The majority of the tow tracks (Fig.16) form a radial array centered on the topographic high studied during Leg 1 (Dredge 15, SL10). A hydrothermal plume signal was observed around the edges of the topographic high in all tracks, extending from ~1650m down to the seabed or approximately 2300m, whichever was shallower. This hydrothermal plume signature was typically characterized by both transmissometer, nephelometer, and ZAPS anomalies. A second, shallower plume signal was observed throughout the Lucky Strike area, at depths of ~1250-1450m. This shallower plume was characterized by a ZAPS anomaly but no accompanying transmissometer or nephel anomalies. These characteristics were exactly those identified originally during Leg 1, ST14 at the same location. These two layers appeared to be the same two plumes (1250-1450m and 1650m-seabed) identified with ZAPS during the deployment of IFREMER hydrocast HY24, approximately 3 miles south of the topographic high.

In addition to searching for vent sites, we conducted a hydrographic experiment in the Lucky Strike segment aimed at constraining the lateral extent and magnitude of hydrothermal inputs into the segment. To this end CTD data, coupled with ZAPS, nephelometer and transmissometer data were collected in two-dimensional sections to the north and south of the vent-field crossing the full extent of the rift-valley, orthogonal to the ridge axis. To the north, this data was collected during SL26, operating the sled in tow-yo mode from W to E (Fig.16). To the south, two pairs of three CTD-hydrocasts were completed, also in tow-yo mode. One set each was completed close to the Eastern and Western rift-valley walls. Coupled with the data from HY24 this scheme provides a W-E cross section of 7 vertical CTD hydrocast profiles across the southern margin of the Lucky Strike segment. During SL26 seawater samples were collected from both 1450m depth (the upper plume) and 1750m depth (the lower plume) at three locations, the western end, the center and the eastern end of the W-E section. Samples were taken for shore-based dissolved 3He and CH4 analyses. Similar samples were taken from the final upcast of each IFREMER 3-profile, tow-yo hydrocast, to the west and east of the rift-valley complementing the samples taken from HY24 during Leg 1.

Finally, a pair of Stand-Alone Pump (SAP) lowerings was also completed near the Lucky Strike vent-field to characterize the nature of the particulate material responsible for the transmissometer anomalies observed below 1650m depth. Both deployments were carried out in the deep channel to the East of the topographic high, close to 37°17' N; 32°14.5' W. The first sample (SL25) was collected from ~1800m depth, the depth of the particle maximum. The SAP filtered 1,105 liters of sea water in 1 hour 50 mins. yielding a clearly visible brown coating on the 1 micron pore-size Nuclepore filter, indicative of hydrothermal input. A second deployment was subsequently carried out at 1150m depth, at least 500 meters above the transmissometer and ZAPS-anomaly plume and 100-300 meters above the ZAPS-only plume to characterize the nature of "background" particulate material settling through the water column of the N. Atlantic Ocean at these latitudes. This time (SL 31) the pump filtered 630 liters. During both of these deplyments SAP provided filtered samples for particulate trace metal and natural radionuclide analyses while specifically designed Mn-impregnated cartridges yielded samples for dissolved natural radionuclide analyses. During the period of pump operation, a suite of water samples was also collected using the sled-mounted rosette for complementary dissolved trace element analyses. Dissolved ^{3}He and CH_4 samples were also taken from these bottles for shore-based analyses.

The southern AMAR segment.

A series of 9 sled deployments was carried out in this area (36°23'-36°28'N) in which ZAPS, nephelometer and transmissometer anomalies had all been identified at ~1800-2200m depth during a Leg 1 sled deployment SV10 (Fig.17). Clear signals occurring between 2050m and 2100m were observed again at all stations. This survey included a series of vertical deployments trending due north from the original station (SL10) converging on a 2200-2400m linear feature named Saturn Ridge during the AMAR Project. Preliminary results indicated that maximum transmissometer anomalies were sited mid-way along this ridge, close to 37°27.6' N. Consequently, a Stand-Alone Pump (SAP) station was occupied at this location at 2050-2100m, the depth of the transmissometer anomaly maximum (SL39; Fig.17). Unfortunately, due to an electronic failure, the pump only operated for a small fraction of the programmed pump-time of 1 hour 50 mins. Nevertheless, a total volume of 80 liters of sea water was passed through the filters during the operating time before pump failure. Although this much reduced volume will not be adequate for dissolved and particulate natural radionuclide analyses, it is anticipated that the proposed particulate trace element analyses will still be possible. As before, seawater samples for complementary dissolved trace element analyses were collected using the sled-mounted rosette system.

The South of AMAR segment.

Two stations were occupied in this segment for vertical sled lowerings, SL 42 and SL 43. Hydrothermal activity had been identified in this segment during Leg 1 (SL 09; 36°02.6' N, 34°07'-34°08'W) in the form of transmissometer and nephelometer anomalies at approximately 1900m depth. Shallower (1600-1700m) nephelometer and transmissometer anomalies of comparable magnitude were observed at station SL42, approximately 1.5 miles east of SL09 at 36°02.4' N, 34°6.7' W. However, all evidence of hydrothermal activity was absent from the sled deployment at station SL43, approximately 10 miles south of stations SL09 and SL42 at 35°53.5' N, 34°13.0' W.

More southerly Leg 2 lowerings.

Two further segments were studied using the ZAPS sled during Leg 2: those immediately north and south of the Oceanographer Fracture Zone. Two vertical sled lowerings were carried out in each segment. In the North Oceanographer segment these stations were occupied towards the center of the segment in 2200-2300m water (SL 44: 35°18.2' N, 34°51.9' W), and to the south of the segment in 2950m-3050m water (SL 45: 35°12.5' N, 34°54.0' W). No evidence for hydrothermal activity was observed at either station.

In the South Oceanographer segment station SL46 was occupied toward the northern end of the segment (35°10.6'-35°10.9' N, 36°20.4'-36°20.7' W) in 3370 - 3470 m water depth. No evidence for hydrothermal activity was observed with the possible exception of a faint ZAPS anomaly below approximately 1500m. By contrast, clear indications of hydrothermal activity were obtained at station SL47, occupied toward the center of the segment (34°51.4' N, 36°26.0' W) in 2200-2250m water depth. At this station, clear ZAPS, nephelometer and transmissometer anomalies were observed at 1500-1800m depth. Loss of shiptime precluded a final deployment of the ZAPS sled (projected sled deployment SL48) toward the southern end of the segment. Thus, we were denied the opportunity to discover whether signals indicative of hydrothermal activity were stronger or weaker towards the southern end of the South Oceanographer segment.

Conclusions for Leg 2 Results

During Leg 2, twenty-nine ZAPS-sled lowerings were completed in six different segments of the Mid-Atlantic Ridge rift-valley between 41° N and 34° N. Strong evidence for hydrothermal activity was found and localized in three of those segments: at the Lucky-Strike vent-field, at the southern end of the AMAR segment and at the northern end of the adjacent South AMAR segment. Further evidence for hydrothermal activity was also obtained from single lowerings at the northernmost and southernmost extremes of the study area for Leg 2, north of the Azores at 41°30' N and at the center of the South Oceanographer segment close to 34°50' N. Of the six segments of the MAR rift-valley investigated during Leg 2, only the North of Oceanographer segment yielded no evidence for hydrothermal activity.

GENERAL CONCLUSIONS

- Plumes were detected with the ZAPS system in 7 of the 17 segments visited during FAZAR.

- The anomalies in Mn and particles detected during this work were small, highlighting the need for sensitive instrumentation during regional surveys.

- Venting does not always produce plumes rich in both particles and Mn. Exploration requires the ability to measure both parameters.

- Any plumes within a 10 km, along-strike distance seemed to be detected with one lowering. i.e. if a vertical lowering did not produce plume signals, towing was also unsuccessful.

SEA BEAM OPERATIONS - A127 Leg 1

August 29 to September 20, 1992
Woods Hole, Massachusetts to Ponta del Gada, Azores

Introduction

A127L1 departed Woods Hole at 9:00 a.m. on Saturday, August 29, 1992 and arrived in Ponta del Gada, Azores, at 8:00 a.m. on Sunday, September 20, 1992. The scientific mission was to locate active venting sites on the Mid-Atlantic Ridge from the Azores Triple Junction (39° N) to the Hayes Fracture Zone at 33° N. The primary sampling techniques included dredging, rock coring, free-fall cores, CTD's, and water sampling.

Because nearly full-coverage EM12 maps were available from a previous Atlante cruise, SeaBeam was used primarily for location of sampling sites and for guidance of CTD's, sleds and rock sampling. Three small surveys were conducted to fill in gaps in the existing multibeam coverage.

Sea Beam Operations

Hardware Modifications and Problems

Equipment refurbishment and testing was done at Woods Hole, MA during the week of August 23, 1992. The keyboard and mouse for the post-processing workstation were replaced. Spare power amplifier parts were resupplied. The SeaBeam system was thoroughly tested and returned.

At Dr. Langmuir's request, the swath plotter and a terminal for the CBSCREEN display were moved to the main lab area. In addition, a video camera was placed so that the cross-track swath could be displayed on a monitor in the main lab. These modifications were made so that all SeaBeam information would be available to the sampling stations in the main lab. The primary swath plotter was moved to the main lab instead of the back-up because the primary swath plotter appeared to be more reliable.

There were two power amplifier failures during the cruise. These failures could be traced to irregularities in the ship's power supply, and would blow the F1 fuse in the system's main power supply, and the F3 fuse in the amplifier's power regulation circuitry. Unfortunately, before the F3 fuse could blow C3, R2 or CR4 in the power regulation circuitry would also be toasted. The first power amplifier that went out was #14; we were able to repair it with the spare power amplifier board as the spare power amplifier proved to be bad, CR4 was an improper component The second amp. to go out was #16, and when it went down, R2 and CR4 were destroyed. We were able to replace R2 with the resistor from amp. #14's power amp. regulator, but we had no spare CR4's aboard. We should be getting the parts we need before the next leg of the cruise.

When only one generator was available, powering up the hydro winch, the A-frame or other heavy load items would overload the system and cause "brown-outs". Other scientific equipment was also found to be sensitive to these power fluctuations. For an 8-hour period each day, both ship's generators were made available for the last half of the cruise. During periods when only one generator was available, SeaBeam was turned to stand-by mode so that the amplifiers were not under load when heavy demand items were turned on.

The LSR was not functioning properly at departure. It was determined that board AB was malfunctioning and causing the time marks to fluctuate. Board AB was replaced. About two weeks later, the recorder would not synchronize correctly in EDGE mode and was turned to the center setting. Occasional fluctuations occurred with the outgoing signal drifting, however cycling the power would correct this symptom. The LSR should be thoroughly refurbished before further use.

The Magnavox 1105 receiver is no longer used by the bridge crew. We, therefore, tried to log course and speed using the Magnavox 1107 receiver. However, if one logs course and speed from the 1107, it is not possible to log GPS data as well. We did have a new Magnavox 4200 GPS receiver, but it is not connected to a time standard and is less reliable than the 1107. After trying unsuccessfully, to log course and speed from the 1107, we opted to use the marginally functional 1105 receiver for course and speed. As the 1105 is to be removed, this is not a long-term solution. We should implement the capability to log course, speed, transit satellite and GPS from either the Magnavox 1107 or the Magnavox 4200 receiver.

There were three Eclipse hang-ups during the cruise.

Software

The only major software modification prior to the cruise was the implementation of the ability to log the Magnavox 4200 GPS receiver. The post-processing computer still had processing programs with improper Julian Day translation. However, up-dated processing programs were available on the real-time system and these were moved to the processing computer.

Data Processing

Daily files were produced by printing the GPS from the Magnavox 4200 in red, and the GPS from the Magnavox 1107 in green on the same plot at a scale of at least 30 inches per degree. By doing this we were able to determine if one of the units became unreliable and when this occurred. This approach gave us the ability to provide the best navigation available to us for any given time. We attempted to avoid using the course and speed data from the Magnavox 1105, even though we were able to log it, because the unit had trouble keeping itself on the proper time and had to be up-dated by the bridge several times daily. It was used sparingly and with acceptable results only when both GPS units appeared to be providing data of dubious quality. Contours at crossing always overlaid each other

When we were satisfied with the corrected navigation, it was remerged with the SeaBeam data. From these data STRIP-NAV(centerbeam files) and averaged data files were produced. Because of the length of time we remained on many of the stations, the data were averaged at a minimum of 2 and a maximum of 1000; this worked quite well. A daily plot was produced of the averaged data at a scale of at least 30 inches per degree; if the data for a day would not fit on one plot at 30 inches per degree, the data was broken into segments that were plotted at a minimum of 30 inches per degree. On average, most day's data was able to be plotted at 60-inches per degree. A plot of the days' averaged data was also made at 1:100000 scale for comparison with the French data. We could not exactly match their projection which was 1:100000 at 37 degrees 30 minutes north; our projections would default to the latitude of the data. Careful observation always found the two data to be in agreement.

3' x 3' dredge, hydrocast and sled sites were processed and gridded using the available SeaBeam data (no EM12 digital data was provided by the French) and tracklines of station work provided. Approximately 90 page-sized charts were produced for the scientists. Data were backed up to Exabyte, but will be modified and combined with the data from the following cruise.

SEA BEAM OPERATIONS - A127 Leg 2

September 25 to October 20, 1992
Ponta del Gada, Azores to Woods Hole, Massachusetts

Introduction

A127L2 departed Ponta del Gada, Azores at 20:00 GMT on 25 September, 1992 and arrived in Woods Hold, MA at 17:30 GMT on 20 October, 1992. Cruise A127L2 was the continuation of cruise A127L1. Their scientific mission was to locate active venting sites on the Mid-Atlantic Ridge from the Azores Triple Junction (40°N) to the Hayes Fracture Zone at 33° N.

The primary sampling techniques included dredging, rock coring, free-fall cores, CTD's, and water sampling. Because nearly full-coverage EM12 maps were available from a previous Atlante cruise, Sea Beam was used primarily for location of sampling sites and for guidance of CTD's, sleds and rock sampling.

One small survey was conducted to fill in gaps in the existing multibeam coverage. One hydrothermal site was dredged on the first leg at 37° 17'N and 32° 17 min. W; the sample contained numerous sulfides, some with mussels attached, fresh glassy bassalt, shrimps, and highly altered rock samples, and was named the "Lucky Strike". This site was examined in more detail on this leg. No new hydrothermal sites were dredged on this leg, but potential sites were sampled with the Oregon State sled at numerous locations.

Sea Beam Operations

Hardware Modifications and Problems

SeaBeam power amplifier #16, which failed on leg one after spare parts were exhausted, was repaired in Ponta del Garda, Azores with parts sent from URI's Ocean Mapping Development Center. We left port with all equipment operational.

At Dr. Langmuir's request, the swath plotter and a terminal for the CBSCREEN display had been moved to the main lab area at the beginning of the first leg. In addition, a video camera was placed so that the cross-track swath could be displayed on a monitor in the main lab. These modifications were made so that all SeaBeam information would be available to the sampling stations in the main lab. The primary swath plotter was moved to the main lab instead of the backup because the primary swath plotter appeared to be more reliable.

There was one power amplifier failure, PA #13, during the transit back to WHOI. The amp. failed for no obvious reason. Initial trouble shooting found CR4(in 2984), Q3(mjl0008), Q6(164-16), and F1 + F2 to all be blown. I replaced all the bad components, and reinstalled the amp., but it blew again, taking out F1 + F3, Q3 and Q6; CR4 was OK. Again, I replaced all the blown components, but rewired one of the spare amps. and installed it instead. All appeared to be OK, although the amp. light initially would not go out either, but I'm sure it is just the light threshold adjustment which in the sea states we had most of the cruise I elected not to play with. I believe the problem with both the original PA #13 + 16 is due to bad T2 transformers, not ship power, as on the first leg.

When only one generator was available, powering up the hydro winch, the A-frame or other heavy load items would overload the system and cause "brown-outs." Other scientific equipment was also found to be sensitive to these power fluctuations. For an 8-hour period each day, both ship's generators were made available for the last half of the cruise. During periods

when only one generator was available, SeaBeam was turned to stand-by mode so that the amplifiers were not under load when heavy demand items were turned on.

The LSR was again erratic, as on the first leg. It would work fine on 'edge' for a week, then for a week only work on center. Because we are planning to have it refurbished I elected to forgo any attempts to repair it from the spares, as it was useable.

During our rough ride through Hurricane Charlie, the monitor in the main lab slipped its tie downs and did a triple gainer, narrowly missing Dr. Terry Plank, before cracking its case on the deck. Dr. Plank scored the monitor's dive at 9.6, deducting .4 points for sloppy entry. I was able to piece the case back together and the monitor has been working normally ever since being resecured.

The Magnavox 1105 receiver is no longer used by the bridge crew. We, therefore, tried to log course and speed using the Magnavox 1107 receiver. However, if one logs course and speed from the 1107, it is not possible to log GPS data as well. We did have a new Magnavox 4200 GPS receiver, but it is not connected to a time standard and is less reliable than the 1107. After trying, unsuccessfully, to log course and speed from the 1107, we opted to use the marginally functional 1105 receiver for course and speed. As the 1105 is to be removed, this is not a long-term solution. We should implement the capability to log course, speed, transit satellite and GPS from either the Magnavox 1107 or the Magnavox 4200 receiver.

There were three Eclipse hang-ups during the cruise

Software

Joyce Miller and I were able to correctly install new software licenses just prior to entering Ponta del Garda, Azores, and there were no other software problems during the cruise.

Data Processing

Daily files were produced by printing the GPS from the Magnavox 4200 in red, and the GPS from the Magnavox 1107 in green on the same plot at a scale of at least 30 inches per degree. By doing this we were able to determine if one of the units became unreliable and when this occurred. This approach gave us the ability to provide the best navigation available to us for any given time. We attempted to avoid using the course and speed data from the Magnavox 1105, even though we were able to log it, because the unit had trouble keeping itself on the proper time and had to be up-dated by the bridge several times daily. It was used sparingly and with acceptable results only when both GPS units appeared to be providing data of dubious quality. Contours at crossing always overlaid each other.

When we were satisfied with the corrected navigation, it was remerged with the SeaBeam data. From these data, STRIP-NAV (centerbeam files) and averaged data files were produced. Because of the length of time we remained on many of the stations, the data were averaged at a minimum of 2 and a maximum of 1000; this worked quite well. A daily plot was produced of the averaged data at a scale of at least 30 inches per degree; if the data for a day would not fit on one plot at 30 inches per degree, the data was broken into segments that were plotted at a minimum of 30 inches per degree. On average, most day's data was able to be plotted at 60 inches per degree. A plot of the day's averaged data was also made at 1:100000 scale for comparison with the French data. We could not exactly match their projection which was 1:100000 at 37 degrees 30 minutes north; our projections would default to the latitude of the data. Careful observation always found the two data to be in agreement.

3' x 3' dredge, hydrocast, rock core, and sled sites were processed and gridded using the available SeaBeam data (no EM12 digital data was provided by the French) and tracklines of station work provided. Approximately 120 page-sized charts were produced for the scientists.

Data were backed up to Exabyte, and combined with the data from the following cruise. The last 2.5 days for transit data were not post-processed due to space limitations on the post-processing system's hard disk prior to doing the final tape back-ups.

Description of SeaBeam file system

The back-up tapes are in VAX/VMS Save-Set format: when restored the directory structure will be identical to that on the ship: (DATA.SEABEAM). Under the SEABEAM directory will be found the A127L1 and A127L2 directories. Under these directories the important sub-directories are: CBEAM, which contains all the raw SeaBeam data for that cruise in daily files; CS, which contains the course and speed data; LIMIT, which contains the limits of any real-time charts that were generated (real-time charts were seldom asked for on either leg): MAG4200, which contains the daily files from the Magnavox 4200 GPS receiver; MESSAGE, which contains the daily message files generated by the computer; and, the most important directory of all, PROCESS, which contains all the post-processing directories.

Under the PROCESS directory the important sub-directories are: AVGCB, which contains all the averaged SeaBeam data merged with the corrected navigation; GRID, which contains all the grids generated for that leg of the cruise. The raw grids have the format NAME.GRD###, while the nibbled grids have the format NAME.GRD###_NBL#. The nibbled grids have the unsupported data around the edges 'nibbled' to with # number of grid cells from the supported data. The PLIM directory contains all the limit files for the charts generated during the cruise. REMERGE contains all the unaveraged SeaBeam data merged with the corrected navigation. RENAV contains the daily corrected final navigation files. STRIPNAV contains the daily one minute pick center beam depth files. And the WINDOWS directory contains all the time and beam exclude files to 'window' out bad data from turns or redundant data from multiple crossings in >EXC files. And the time windows for rock core and dredges in the >WIN files.

I had a very pleasant time on the two legs of this adventure in science, and I look forward to sailing with all of you again. BON VOYAGE ALWAYS, SHEF COREY.

ACKNOWLEDGMENTS

The entire scientific party would like to thank Captain Howland and the crew of the Atlantis II for their excellent support during FAZAR. The deck crew, mates and engine department were all very helpful throughout both legs. They ensured that the science operations ran smoothly, and gave assistance when the operations were not running as smoothly as desired. Shef Corey and Skip Gleason also deserve special commendation. Shef produced many splendid Sea Beam maps that put our work in topographical perspective. Skip Gleason made sure that the traction winch ran flawlessly during FAZAR. Skip also helped a great deal with many technical aspects of the sled deployments.

Our program would also not have been possible without the SIMRAD maps collected by our French FARA colleagues on R/V Atalante in 1991, and made available to this mission by David Needham. These maps allowed effective planning and implementation of our sampling programs. Bob Detrick also made processed versions of these maps which were very helpful for pre-cruise planning and presentation of post-cruise results.

We are grateful.

Appendix 1. DREDGE LOG

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*

FAZAR **DREDGE LOG**

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*

STATION ID **A127-5-DR01** **05 Sep 92**

Seamount at southern end of S. Hayes segment

Dredged north across flat summit

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments
4:16	33	9.840	39	14.750	2725		Dredge in water
4:37	33	10.131	39	14.866	2700		Pinger on at 150 wire out
5:22	33	10.426	39	14.872	2706		Dredge on bottom
5:38	33	10.571	39	14.754	2700		80m Sep. Many small bites
5:45	33	10.686	39	14.670	2723		Dredge off bottom
6:47							Dredge on Deck
							5 lbs of glass frgmts with iron coating

STATION ID **A127-12-DR02** **06 Sep 92**

Axial valley volcano adj. to fracture zone

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments
0:52	33	42.423	39	3.230	3051		Dredge in water
0:58	33	42.423	39	3.230	2984		Pinger on at 150 wire out
1:44	33	43.173	39	3.078	3058	3072	Dredge on bottom
2:00	33	43.340	39	2.973	3013	3175	Bites,100M sep, 7000 bites
					3197		Max depth with 9000 lbs tension on wire
2:07	33	43.395	39	2.950	3002	3209	Paid out wire
2:20	33	43.542	39	2.900	3002	3129	Off bottom
3:31	33	44.409	39	2.422	2902		Dredge on Deck
							5 kg of bsalt pillow frmts, one type

STATION ID **A127-14-DR03** **06 Sep 92**

Narrow ridge on west side of rift

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments
9:24	33	38.891	38	12.307	3899		Dredge in water
9:30	33	38.809	38	12.343	3937	153	Pinger on at ~150 m
10:14	33	38.976	38	12.313	3904	3100	800m from the bottom
10:52	33	38.998	38	12.289	3893	3918	On bottom, 020°
11:10	33	39.202	38	12.215	3847	3977	Workings
11:24	33	39.408	38	12.218	3930		7000lbs
11:29	33	39.408	38	12.199	3921		c/c 025°
11:40	33	39.512	38	12.154	3917		heading 035°
11:52	33	39.640	38	12.036	3892		off bottom
12:05	33	39.665	38	11.891	3881		winch control transferred
13:25							dredge on deck
							40 kg bas. pillow frgmts, glassy rinds; 4 types
							(glass >50 g)

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
STATION ID	**A127-16-DR04**						**07 Sep 92**
Volcanic ridge along center of the ridge valley.							
2:22	33	50.477	37	44.155	3400		Dredge in water
2:27	33	50.446	37	44.233	3402		pinger on, going down
2:40	33	50.375	37	44.425	3355	1200	heading 171
2:46	33	50.371	37	44.411	3302	1700	ship coming around slowly, heading 64
2:56	33	50.406	37	44.220	3403	2400	heading 60
3:06	33	50.490	37	44.156	3402		transfer winch control to lab, heading 59
3:12	33	50.514	37	44.111		3200	
3:15	33		37				on bottom
3:18	33	50.488	37	44.099			turn and make course 020 along ridge crest 0.5-1.0 lt, pinger 50 mab
3:38	33	50.732	37	44.000	3379		c/c to move a few hundred m to east, ease up
→ 3:49	33	50.821	37	43.825	3287		
3:58	33	50.964	37	43.778	3278		
4:09	33	51.120	37	43.729	3258		
4:34	33		37				off bottom, just nibbles
4:39	33	51.586	37	43.500	3308		
5:35	33	52.159	37	43.129	3280		dredge on deck -- plag-phyric andesite 13 kg (1 piece), 6 kg (boulder) + small pieces some glass: (glass>50 g)
STATION ID	**A127-17-DR05**						**07 Sep 92**
6:12	33	54.640	37	42.727	3087	0	dredge in water
6:17	33	54.655	37	42.733	3039	150	pinger on, dredge going down 70 m/min
6:42	33	54.597	37	42.765	3089	1850	
6:59	33	54.608	37	42.740	3090	2700	winch control transferred to lab
7:04	33	54.623	37	42.701	3070	3075	dredge on bottom
7:10	33	54.631	37	42.656	3045		
7:15							increase speed (not moving)
7:22	33	54.638	37	42.558	3028		
7:29							c/s to 1 kt over ground (from 0.5 kt)
→ 7:36	33	54.693	37	42.382	3013		
7:41							9500 lb bite, pinger 65m off bottom
7:48	33	54.756	37	42.167	2966		8000 lb bite, otherwise working along
8:03	33	54.860	37	41.891	3018		dredge off bottom
8:10						2900	transfer winch control, up at 60m/min
9:04	33	54.955	37	42.326	3004	150	pinger up
9:10							dredge on deck, old stuff 70 kg rocks and glass; 5 types: (glass>50 g)

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID	**A127-022-DR06**						**07 Sep 92**
20:54	34	4.770	37	13.514	3540		dredge hits water
20:59	34	4.796	37	13.512	3541		pinger on
21:01	34	4.799	37	13.521	3542		on the way down, 50m/min
21:55	34	4.875	37	13.250	3467	3501	dredge on bottom
22:47	34	5.161	37	12.589	3476		dredge on way up, max speed 50-70m/min
23:53	34	6.146	37	11.749	3317		on deck
							mud + 4 small rock chips
Station ID	**A127-022-DR07**						**08 Sep 92**
							Sea Beam is down due to electronics problem
6:49	34	20.717	37	6.268	3000		dredge in water
6:43	34	20.694	37	6.225			pinger on
7:32	34	20.692	37	6.224	3042		dredge 200m above the bottom
7:35	34	20.698	37	6.223	3016		
7:53	34	20.879	37	6.154	2998		heading 040-050 010 over ground
8:27	34	21.193	37	6.058	2904	3124	
8:30							6000lb bite
8:33							7500lb bite with wire pulling to help
8:40	34	21.378	37	5.999	2954		pinger 120m separation
8:56	34	21.621	37	5.905	2978		off bottom
9:06					2550		winch control transferred
10:00	34	21.374	37	6.129	2944		on deck
							50 kg unaltered aphiric basalt + glass; 8 types
							(glass > 100 g, clean, fresh)
Station ID		**A127-037-DR08**					**09 Sep 92**
6:31	34	42.386	36	29.108	2768		dredge in water
6:35	34	42.372	36	29.026	2763		pinger on
6:41	34	42.407	36	29.019			
6:51	34	42.478	36	29.107	2778	1200	
7:04	34	42.502	36	29.078	2762	2000	
7:12	34	42.502	36	29.084	2780	2500	
7:23	34	42.493	36	29.137	2789	2890	on bottom, c/s 1 kt toward target 34°42.6, 36°29.9
7:41	34	42.539	36	29.424	2768		
7:51							5000 lb bite, working, not in sed. On basin floor
7:53							also 5000 lb
7:54	34	42.569	36	29.668	2721		
8:06	34	42.604	36	29.867	2678		off bottom
8:57	34	42.592	36	29.905	2665		pinger up
9:02	34	42.582	36	29.891	2670		on deck
							70 kg boulders altered aphiric basalt; very little glass
							5 types: (tons of glass, 50 g clean)

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-046-DR09**					**10 Sep 92**
7:14	35	12.659	34	46.150	1756		In the water
							pinger on at 250 m
7:19							no pinger trace, returning to the surface
7:28	35	12.547	34	46.195	1751	250	checked pinger, going down again
7:47	35	12.603	34	46.217	1817	1500	transferring winch control to lab
7:49							starting down
7:58	35	12.650	34	46.201	1794	1790	on the bottom, getting underway
8:07	35	12.719	34	46.174	1751	1890	winch stopped, waiting for bites
8:10					1726		pulling wire in
8:14					1674	1798	sep = 170
8:16	35	12.848	34	46.087	1663	1777	sep = 200, winch stopped, start paying out
8:25	35	12.951	34	46.022	1618		pulling wire in, a few little bites?
8:36	35	13.097	34	45.961	1533	1766	paying out again
8:44	35	13.229	34	45.887	1477	1800	biggest bite yet
8:51	35	13.240	34	45.905	1484		sep100 m, small bite, pulling wire in, almost at waypoint
9:17	35	13.296	34	45.929	1519	1430	off the bottom
9:48	35	13.179	34	46.330	1772		on deck
							60 kg scoriacous basalt; very little glass; 8 types
Stat. ID		**A127-058-DR10**					**11 Sep 92**
11:33	35	56.599	34	10.024	2332		In the water
12:12	35	56.670	34	9.988	2326	2300	
12:15	35	56.681	34	9.987	2324	2300	winch transferred heading 015
12:18					2329		on bottom
12:44	35	56.931	34	9.727	2313	2428	on summit heading NNE 030
13:03	35	57.222	34	9.563	2312	2464	heading 010
13:26							off bottom
13:30	35	57.719	34	9.690	2304	2250	winch transferred
14:20	35	59.226	34	9.340	2453		dredge on deck
							100 kg pillow coated moderately fresh glass; 7 types
							large amount of biological stuff (glass: 150 g)
Stat. ID		**A127-061-DR11**					**11 Sep 92**
20:40	36	9.182	33	59.238	3065		in the water, at base of small seamount
21:30	36	9.123	33	59.132	3053	3100	at bottom
22:14	36	9.643	33	58.506	3043	3030	off bottom
23:08	36	9.429	33	58.676	2985		on deck
							25 kg of very fresh glass + glass rind on basalt pieces
							3 types

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Stat. ID		**A127-064-DR12**					**12 Sep 92**
along spine of ridge at south end of AMAR Segment, offset to W from the NVZ line of AMAR							
7:26	36	17.021	33	45.748	2370		in the water
7:31	36	17.022	33	45.747	2366	150	pinger on, going down
8:10	36	17.025	33	45.646	2378		dredge on the bottom
8:29	36	17.262	33	45.601	2336		
8:32							c/s from 0.8kts to 1-1.5kts
8:55	36	17.762	33	45.429	2178	2578	
9:19	36	18.221	33	45.335	2195	2340	off the bottom
10:03	36	18.144	33	44.670	2342		pinger on deck
10:13	36	18.031	33	44.455	2523		dredge on deck
							125 kg almost aphyric basalt pillows; 5 types; alteration + vesicules present (clean glass looks rerally fresh)
Stat. ID		**A127-085-DR13**					**13 Sep 92**
main ridge in Short seg N of FAMOUS							
22:33	36	58.899	32	56.896	2655		in the water
22:38	36	58.939	32	56.905	2691	150	pinger on
23:24	36	59.060	32	56.750	2660	2775	on bottom, pinger ~50m oft bottom, 38°, .9kts
23:47	36	59.480	32	56.645	2676	2775	cruising 44°, 1.3 kts.
0:03	36	59.743	32	56.495	2637	2847	change to 70° over ground (77°), .9kts.
0:33	36	59.863	32	56.158	2719		dredge off bottom
0:47	37	0.121	32	56.246	2662		37°N!!! noted for sheer excitement factor
1:25	37	0.950	32	56.185	2804		On deck
							75 kg aphyric bas. pillows + plag. phyric rinds +station glass; 4 types
Station ID			**A127-089-DR14**				**14 September, 1992**
northern edge of the seg N of FAMOUS							
7:32	37	3.704	32	53.332	2978		in the water
8:21	37	3.707	32	53.311	2985	3072	on bottom, pinger ~50m off bottom, 38°, .9kts
9:28	37	3.212	32	54.203	2947	3185	moving west cross over the ridge
9:35	37	3.183	32	54.332	2940		big bite 10
9:41	37	3.180	32	54.481	2941		dredge off bottom
10:44	37	4.577	32	53.784	3104		dredge on deck
10:57	37	4.772	32	53.650	3105		all secure; get underway
							5 kg OLD highly altered glass + 1 hand sized rock

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-093-DR15**					**14 September, 1992**
central volcano of broad segment							
19:08	37	17.485	32	16.989	1693		in the water, and going down
19:31	37	17.434	32	16.953	1706		at the central volcano of the central volcano of the central volcano of the wide segment.
20:27	37	17.817	32	16.259	1571	1747	big bite, ship over summit, pinger on summit.
20:40	37	17.942	32	16.205	1617	1515	off bottom, coming up!
21:06	37	17.864	32	16.074	1647	149.3	pinger on deck
21:12	37	17.840	32	16.052	1648		on deck, MUSSELS! >200 kg vesicular basalt + "the freshest glass ever seen + sulfides + alived mussels
Station ID		**A127-099-DR16**					**15 September, 1992**
60M high nose in center of rift valley, north end of segment							
7:17	37	27.527	32	13.456	2956		in water
7:22	37	27.557	32	13.449	2955		pinger on
8:08	37	27.479	32	13.489	2952		on bottom
8:15							minor workings
8:47							bites starting
8:56	37	26.916	32	13.856	2878	3075	dredge caught, big bite
9:07	37	26.741	32	13.982	2879	3014	dredge off bottom; coming up
10:09	37	26.494	32	13.805	2878		on deck 60 kg weathered pillows; inceasingly vesicular to the interior; one type.
Station ID		**A127-105-DR17**					**15 September, 1992**
summit cone(~150m) on lg split volcano in rift							
21:52	37	50.098	31	31.124	1009		in water
22:21	37	50.176	31	31.088	1009		on bottom
23:01	37	50.757	31	31.456	843		off bottom
23:25	37	50.921	31	31.535	988		on deck 50 kg pillows, some plqg. phyric, some highly vesicular, dark brown to black on the exterior; 3 types
Station ID		**A127-109-DR18**					**16 September, 1992**
40 m high ridge, N of split volcano							
4:22	37	58.785	31	28.309	1708		in water
4:25	37	58.886	31	28.268	1709		pinger on
4:27							going down (70-75 m/min)

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
4:44	37	58.570	31	28.089	1713		
5:03	37	58.758	31	28.263		1836	on bottom, 50 m separation
5:06							c/s 1 kt cog toward target (target 37 59.4 31 28.1 or W of that, not E)
5:18	37	59.026	31	28.274	1734		
5:28							Dredge got caught, swung up to 8000-10,000 2 or 3 times, then over 10,000. Started paying out too late, tension swung up to 13,000 before winch responded. Got 5000-7000 lb bites after that, did not lose the dredge.
5:33	37	59.240	31	28.188			
5:48	37	59.448	31	28.131	1725	1815	off bottom
6:27	38	0.070	31	28.604	1859		on deck 20 kg aged pillows;sparsely plag. phyric, vesicules present; orange ateration on glass; 3 types
7:05							bridge securing the ship, getting underway
Station ID		**A127-110-DR19**					**16 September, 1992**
10:49	38	7.152	30	43.643	1937		dredge in water sea is rough
11:04	38	7.142	30	43.692	1944	910	
11:08	38	7.142	30	43.667	1953	1230	heading 045
11:18	38	7.184	30	43.611	1918	1900	heading 008 winch transferred
11:29	38	7.361	30	43.588	1877	2045	on bottom
11:48	38	7.722	30	43.581	1957	2020	off bottom
12:30	38	8.361	30	43.531	1804		on deck 40 kg severely altered aphyric pillow; glass highly palagonized; 1 type
Station ID		**A127-119-DR20**					**16 September, 1992**
23:38	38	17.832	30	41.042	815		in water
23:44	38	17.876	30	41.148	832		pinger on
23:51	38	17.935	30	41.109	782	600	winch transferred
23:58	38	17.854	30	41.077	797		seabeam off, interference
0:04	38	17.765	30	41.156		880	on bottom
0:39	38	18.194	30	40.780	599	670	dragging
0:56	38	18.347	30	40.637	750	640	off bottom
1:01	38	18.411	30	40.573	732	518	winch transferred
1:11	38	18.512	30	40.467	712	~150	pinger off
1:15	38	18.569	30	40.437	733		dredge on deck >99% coral; few pieces aphyric vesicular highly altered basalt; no glass

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-123-DR21**					**17 September, 1992**
5:47	38	29.321	30	16.055	2101		in water
5:54	38	29.373	30	16.057	2064		pinger on
6:38							on bottom
6:48	38	29.453	30	15.924	2095		
7:02							Seabeam back on
7:08	38	29.706	30	15.741	1820		Seabeam off
7:25	38	29.878	30	15.623	1804		Seabeam on
7:46	38	30.052	30	15.463	1822		off bottom
8:35							on deck
							8 kg of glass + nearly aphyric basalt with glassy rind
							2 types
Station ID		**A127-136-DR22**					**18 September, 1992**
up and along 200M high ridge in center of rift valley							
Along strike (W of) northern FZ volcano							
7:02	39	2.324	30	1.475	1373		in water
7:09	39	2.324	30	1.475	1373		pinger on
7:35	39	2.269	30	1.501	1386	1462	on bottom; pinger 65M off bottom
8:03	39	2.668	30	1.663		1461	pinger 120M off bottom
8:30	39	3.252	30	1.836		1380	off bottom
9:00	39	3.451	30	1.976	1344		pinger on deck
9:05	39	3.503	30	1.996	1384		dredge on deck
9:18	39	3.506	30	1.696	1321		all secure
							100 kg black pillow + lava flows, aphyric, vsicular;
							glass mostly fresh; 3 types
Station ID		**A127-139-DR23**					**19 September, 1992**
Seamount about 70km east of Azores triple junction							
13:54	38	40.340	29	15.135	1705		in water
13:59	38	40.365	29	15.054	1643	150	pinger on
14:04	38	40.340	29	15.060	1643	600	stop winch; come up to 300M, move SW
14:20	38	40.215	29	15.284	1802		starting down again
14:27	38	40.152	29	15.316	1832	800	
14:36	38	40.314	29	15.332	1777	1500	c/c 100°, 0.5-1.0 knot
14:45	38	40.292	29	15.315	1785		on bottom; pinger 80M off
14:56	38	40.263	29	15.028	1652		stop; moving too fast (1.5knots)
15:00	38	40.363	29	14.580		1767	The dredge got stuck and the ship had to do some fancy manuvering to get above it, and then Charlie pulled it off in text book style. What excitement!!!!!!!!!!!!!!!
15:12	38	40.203	29	15.013	1724		Ship over dredge
15:13	38	40.254	29	15.065			broke off; off bottom
15:48							all secure
							100 kg old vsicular altered basalt, no glass
							coral, marine life

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID	**A127-141-DR24**						**27-Sep-92**
Seamount S of the Kurchatov fracture zone							
6:19	40	31.237	29	32.303	3021		in water
6:25	40	31.134	29	32.320	2961		pinger on
7:00	40	31.245	29	32.360	3012	2200	Underway to way point
7:10	40	31.320	29	32.230	3021		stop winch
7:16	40	31.349	29	32.202	?	3154	on bottom, seabeam off to see PDR
7:50	40	31.526	29	31.628	3047	2800	off bottom
8:43	40	31.917	29	31.116	3136		pinger off wire
8:47	40	31.956	29	31.113	3129		on deck, all secure
							40 g very fresh glass chips, 20 grams with alteration
Station ID	**A127-153-DR25**						**28-Sep-92**
8:45	40	15.478	29	35.720	2506		in water
8:48	40	15.502	29	35.729	2505		pinger on
9:25	40	15.480	29	35.725	2500	2530	on bottom, underway at 1knt
9:31	40	15.650	29	35.726	2442	2588	winch stopped, sep 75m
10:19	40	16.737	29	35.661	2390	2275	off bottom, very poor pinger signal (seabeam off)
10:57	40	16.955	29	35.755	2393	148	pinger off
11:04	40	16.958	29	36.048	2243		on deck
11:09	40	16.375	29	36.115	2403		all secure
							8 minute objects including rock and a fresh glassy chip
Station ID	**A127-162-DR26**						**28-Sep-92**
22:40	39	54.423	29	40.287	2073	0	in water
22:43	39	54.441	29	40.337	2070	150	pinger in water
23:41	39	54.469	29	40.332	2068	2072	dredge on bottom
0:22	39	54.422	29	41.587	2117	2115	dredge off bottom
1:02	39	54.556	29	42.112	2070	149	pinger off
1:06	39	54.575	29	42.147	2017		on deck
							10 kg very fresh rocks with glassy rinds; two types
Station ID	**A127-167-DR27**						**29-Sep-92**
6:24	39	30.173	29	44.108	2293		in water
6:29	39	30.170	29	44.078	2286	150	pinger on
7:10	39	30.311	29	44.270		2288	on bottom
8:20	39	30.120	29	44.460	2289	2236	off bottom
9:04	39	30.463	29	45.072			on deck00/*.
							15 kg fresh pillows, thick glass rinds; two types

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-168-DR28**					**29-Sep-92**
10:08	39	29.743	29	54.012	1869		in water
10:11						150	pinger on
10:42	39	29.879	29	53.957	1880		on the bottom
11:24	39	30.212	29	54.312	1900	1770	off the bottom
11:56	39	30.566	29	54.636	1997	150	pinger off
11:59	39	30.639	29	54.668	2002		on deck
							biological dredge; ! rock Mn coating + altered glass fragments
Station ID		**A127-169-DR29**					**29-Sep-92**
12:57	39	25.855	29	50.743	1862		in water
13:01	39	25.956	29	50.750	1854		pinger on
13:39	39	25.922	29	50.725	1900		on bottom
14:32	39	26.490	29	51.210		1795	off bottom
15:16	39	27.405	29	51.746	1909		pinger off
15:21	39	27.593	29	51.903	1911		on deck
							150 grams fresh glass rinds with some palagonite
Station ID		**A127-177-DR30**					**30-Sep-92**
2:18	38	45.206	30	5.778	1203	0	in water
2:24	38	45.130	30	5.828	1162	150	pinger on
4:33	38	45.007	30	5.608	1114	980	on bottom, wire has an angle.
5:08	38	45.827	30	4.922	1160		on deck
							95% rocks (1 type) vesilar, glass rinds; 50 kg
							5% biology
Station ID		**A127-179-DR31**					**30-Sep-92**
13:12	38	47.076	30	2.432	1350		in water
13:16	38	47.090	30	2.434	1304	200	pinger on
13:30	38	47.800	30	2.400	1200	1350	on bottom, wire has an angle.
14:00	38		30		1100	????	off bottom after two heavy pulls
14:39	38	48.722	30	0.792	1083	200	pinger off
14:43	38	48.800	30	0.555	1032	200	???? Line caught in screws of ship. Sheared off.
Station ID		**A127-182-DR32**					**1-Oct-92**
1:24	38	4.510	31	24.748	2210		in water
1:28	38	4.421	31	24.802	2197	200	pinger on
2:10	38	3.736	31	24.703	?	2300	on bottom, seabeam off
3:12	38	3.475	31	26.248		2397	off bottom
3:56	38	2.972	31	26.968	2009	200	pinger off
4:04	38	2.854	31	26.980	2036		dredge on deck
							only few pumice rounded fragments

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-183-DR33**					**1-Oct-92**
4:25	38	3.533	31	26.670	2144		in water
4:30	38	3.489	31	26.634	2130	200	pinger on
5:03	38	2.880	31	26.738		2275	on bottom
5:14	38	2.842	31	26.789	2050	2234	big bites
5:53	38	2.383	31	26.695	2050	2158	off bottom
6:38	38	2.185	31	26.292	2012	200	pinger off
6:44	38	2.222	31	21.306	2026	0	dredge on deck
							one old pillow fragment, no fresh glass but a piece of altered rind with fresh glassy interior. rest: biology
Station ID		**A127-192a-DR34**					**1-Oct-92**
						info neve	put in station log, so next operation got station 193
15:02	37	35.045	31	35.584	2092		IN WATER
15:05							PINGER ON
15:36	37	35.390	31	36,13	1950		On bottom, bites, stuck 3 or 4 times
16:20	37	35.050	31	36.190	1990		Off bottom
16:54							Pinger off
17:00							On deck
							50 kg old pillow fragments with altered glassy rinds. Basalt is aphyric and slightly vesicular
Station ID		**A127-211-DR35**					**4-Oct-92**
7:49	37	25.257	32	16.187	2718		dredge in water
7:52	37	25.269	32	16.151	2728		pinger on
8:33	37	25.268	32	16.190		2730	Dredge on bottom
							<50 g of material; altered glassy plag p[hyric rind glass chip inside carbonate ooze
Station ID		**A127-214-DR36**					**5-Oct-92**
0:36	37	15.740	32	17.977	1921		in water
0:41	37	15.796	32	17.973	1890	150	pinger on
1:04	37	16.045	32	17.935	1859		taking control of the winch
1:26	37	15.369	32	17.274		2274	on bottom, wire has an angle
2:05	37	15.722	32	16.158		2267	trying to move north to dredge uphill, getting bites
2:12	37	15.825	32	16.166		2220	more bites
2:39	37	16.116	32	16.043		2085	still on the bottom
2:44	37	16.178	32	15.969		1995	**off bottom**
3:14	37	16.309	32	15.457		148.5	pinger off
3:25	37	16.365	32	15.372	1874		on deck
							300 kg rocks; 12 types
Station ID		**A127-222-DR37**					**5-Oct-92**
17:40	Sattelite Not Working						IN WATER
17:46	37	15.446	32	18.113	1957	150	PINGER ON at 150m
18:17	37	15.341	32	17.979	1959	2026	On bottom
20:34	37	14.656	32	17.702	1967	1982	Off bottom

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
21:12	37	14.906	32	16.852	1949	150	Pinger off
21:18	37	14.928	32	16.826			On deck
							1 big rock 25 kg; one type
Station ID		**A127-227-DR38**					**6-Oct-92**
6:49	37	6.618	32	20.863	2870?		in water
6:53	37	6.556	32	20.823	2870?	149	pinger on
7:45	37	6.658	32	20.852		2930	on bottom
8:32	37	7.295	32	20.934		2992	bites
8:41	37	7.205	32	20.871		2849	off bottom
9:27	37	6.623	32	20.224		146.8	pinger off
9:32	37	6.555	32	20.133			on deck
							1 kg total; old pillow, altered glass rind
							volcanic scoria
Station ID		**A127-230-DR39**					**6-Oct-92**
18:44	36	47.570	33	25.750	1129		in water
18:50	36	47.641	33	25.749	1104	150	pinger on
19:07	36	47.540	33	25.780			on bottom
20:05	36	46.659	33	26.207		1065	off bottom
20:30	36	46.981	33	26.204	988		on deck
							1 plag. phyric rock, altered; biology
Station ID		**A127-258-DR40**					**9-Oct-92**
5:33	35	46.720	34	13.453	2520		in water
5:36	35	46.674	34	13.523	2517	150	pinger on
6:14	35	46.717	34	13.436		2514	On bottom
6:26	35	46.592	34	13.475		2528	Several bites ~5-6k
6:33	35	46.534	34	13.528		2540	Small stucks, big bites 6-9ks for a while, IT'S COOL!
6:48	35	46.404	34	13.569		2592	Small bites: < 5Ks
6:53	35	46.406	34	13.581		2592	Small bites: < 5Ks
6:57	35	46.369	34	13.575		2592	Hundreds of small but promising bites:Fresh Pillow Buds!
7:02	35	46.339	34	13.584		2567	Good bites!!!
7:12	35	46.196	34	13.631	2373		Off bottom
8:00	35	45.979	34	14.616		147	pinger off
8:05	35	45.986	34	14.852		147	on deck
							100 kg fresh materrial; 5 types
Station ID		**A127-259-DR41**					**9-Oct-92**
9:07	35	39.928	34	17.019			in water
9:09							pinger on
9:49	35	39.930	34	16.982	2760	2780	on bottom
10:21	35	40.580	34	16.694	2634		off bottom
11:04	35	40.516	34	17.658	2960		on deck
							9 pieces glassy pillow crust; 1 type

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-260-DR42**					**9-Oct-92**
12:15	35	40.520	34	27.380	3168		in water
12:19	35	40.540	34	27.380	3169	150	pinger on
12:55	35	40.296	34	27.468	3138	3259	on bottom, PDR off for awhile to add paper
13:43	35	39.672	34	27.929	3091	3135	off bottom
14:22	35	39.003	34	28.419	3133	150	pinger off
14:29	35	38.867	34	28.361			on deck
							empty
Station ID		**A127-262-DR43**					**9-Oct-92**
17:47	35	31.471	34	46.922	3238		in water
17:52	35		34			150	pinger on
18:41	35	31.464	34	46.944	3218	3250	on bottom
19:26	35	30.907	34	47.118	3074		off bottom
20:15	35	31.047	34	47.574	3165		on deck
							flat pieces of very altered glass
							+ sediment
Station ID		**A127-268-DR44**					**10-Oct-92**
2:19	35	19.551	34	51.497	2404		in water
2:23	35	19.563	34	51.523	2396	150	pinger on
2:58	35	19.539	34	51.563		2408	on bottom
3:20	35	19.339	34	51.627		2418	small 4.5K bites
3:30	35	19.201	34	51.611		2430	small bites ~5ks
3:42	35	19.106	34	51.718		2468	6 and 7K bites
3:47	35	19.050	34	51.671		2447	6K bite
3:51	35	19.016	34	51.670	2370	2413	off bottom
4:33	35	18.553	34	52.050	2370	150	pinger on deck
4:37	35	18.475	34	51.991	2353		on deck
							30 kg, pretty fresh basalt; 5 types
Station ID		**A127-270-DR45**					**10-Oct-92**
7:20	35	17.577	34	51.756	2430		in water
7:24	35	17.581	34	51.745	2435	150	pinger on
7:55	35	17.719	34	51.862		2470	on bottom
8:04	35	17.851	34	51.846		2488	A small bite ~ 4K
8:07	35	17.882	34	51.850		2488	Several mall bites ~ 5K
8:12	35	17.979	34	51.884		2508	Many small bite ~ 4.5K
8:19	35	18.058	34	51.883		2510	Several small but promising bites ~4.5K
8:21	35	18.136	34	51.880		2510	Many excellent bites ~ 5-6K
8:23	35	18.136	34	51.880		2501	A big one ~ 9K!!!
8:37	35	18.361	34	51.886		2463	A big one ~ 7K!!!

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
8:41	35	18.411	34	51.879		2440	Off bottom
9:20	35	18.761	34	51.935	2419		on deck
							106 kg, 5 types
Station ID		**A127-272-DR46**					**10-Oct-92**
11:16	35	14.230	34	48.989	2037		in water
11:19						150	pinger on
11:48	35	14.212	34	49.014	2038	2055*	on bottom
12:33	35	15.002	34	49.338	1822	1985	off bottom
							pinger off
13:10	35	15.002	34	49.338			on deck
							off axis; little Mn coating; 4 types
Station ID		**A127-273-DR47**					**10-Oct-92**
14:19	35	9.494	34	40.627	1624		in water
14:21						148	pinger on
14:45	35	9.503	34	40.773	1614	1580	on bottom
16:45	35	10.910	34	41.741	1141	1155	off bottom
17:05							pinger off
17:10							on deck
							no rock; biology
Station ID		**A127-277-DR48**					
23:39	35	5.423	34	56.685	4080		in water
23:43	35	5.389	34	56.665	4083	150	pinger on
0:40	35	5.445	34	56.762	?	4118	on bottom
0:59	35	5.640	34	57.018		4155	Small bites ~ 5.5K
1:04	35	5.641	34	57.031		4166	Small bites ~ 6K
1:09	35	5.757	34	57.155		4191	Good ones ~6Ks
1:31	35	6.035	34	57.457		4232	Small ones ~ 6Ks
1:35	35	6.072	34	57.499		4244	Small ones ~ 6Ks
1:48	35	6.221	34	57.603			A good one ~ 6.5 k
1:49	35	6.221	34	57.603			A good one ~7 k
1:51	35	6.258	34	57.627		4163	An excellent one ~8 k
1:54	35	6.298	34	57.617	3830	4120	off bottom
3:09	35	6.453	34	58.435	3773	150	pinger off
3:13	35	6.426	34	58.422			on deck

Very promising dredge, unfortunately, too sad result!!!
Everything's gone; bag of chains, burlap-catcher, & can outside of the dredge!!! Too sad!

Station ID		**A127-278-DR49**					
9:24	35	14.978	36	15.245	3797		in water
9:26						150	pinger on
10:18	35	15.051	36	15.288	3797		on bottom
10:40	39	15.802	36	16.254	3570	3700	off bottom
12:34							pinger off
12:39	35	15.057	36	17.033	3879		off bottom

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-286-DR50**					
3:54	34	50.116	36	25.817	2194		in water
4:04	34	50.185	36	25.649	2197	150	pinger on
4:35	34	50.275	36	25.805		2215	on bottom
4:49	34	50.364	36	25.944		2270	Small bites ~ 4.5Ks
4:52	34	50.341	36	25.974		2256	Small bites ~ 4Ks
4:57	34	50.427	36	26.061		2237	Small bites ~ 4Ks
5:01	34	50.433	36	26.093		2273	Small bites ~ 4Ks
5:09	34	50.590	36	26.167		2317	A good bite! almost 5Ks
5:18	34	50.685	36	26.140		2365	Excellent bites-almost a stuck, but 5-7Ks
5:20	34	50.714	36	26.142		2340	Off bottom
6:02	34	51.342	36	26.195	2272		pinger off
6:07	34	51.342	36	26.195	2272		on deck
							1 kg grey basalt + altered glass rind
Station ID		**A127-288-DR51**					
9:09	34	49.026	36	21.178	1743		in water
9:12	34	49.071	36	21.209	1734	150	pinger on
9:39	34	49.138	36	21.197		1790	on bottom, two 9k bites and several smaller nibbles
10:26	34	50.039	36	21.095	1649	1633	off bottom
10:52							pinger off
10:56	34	50.614	36	20.683	1686		on deck
							completely altered pieces of basalt
Station ID		**A127-292-DR52**					
15:36	34	34.430	36	30.820	3018		in water
15:40	34	34.420	36	30.820	3002	150	pinger on
16:27	34	34.474	36	30.977		3044	on bottom, a few good bites
17:24	34	34.829	36	31.800	2940	3020	off bottom
18:13	34	35.407	36	32.310		150	pinger on board
18:17	34	35.396	36	32.291			on deck
							3 kg plag. phyric basalt + glassy altered rinds
Station ID		**A127-293-DR53**					10/12/92
20:50	34	31.522	36	59.430	3109		in water
20:52	34	31.537	36	59.418	3115	150	pinger on
21:37	34	31.482	36	59.567		3115	on bottom
22:50	34	31.543	36	59.989	3009	3110	off bottom
23:35	34	31.886	37	0.841	3109	150	pinger off
23:40	34	31.838	37	0.816	3108		on deck
							altered piece of pillow (20 kg) + 2 kg of altered glass rinds

Time GMT	Lat °N	Lat' Min.	Lon °W	Long' Min.	Depth meters	Wire Out	Comments (weather,etc.) *sep=separation*
Station ID		**A127-295-DR54**					
5:13	34	3.997	37	39.148	3397		in water
5:17	34	4.054	37	39.063	3395		pinger on
6:01	34	4.025	37	38.973		3450	on bottom
6:27	34	3.545	37	38.911		3560	A small bite ~ 5ks
6:35	34	3.476	37	38.852		3575	Several small ones ~ 4ks
7:06	34	3.100	37	38.700		3643	off bottom (estimate off position)
8:02	34	2.411	37	38.895	3274	150	pinger off
8:05	34	2.418	37	38.924	3263	0	on deck
							piece of pillow 30 kg + 5 kg smaller
							pieces + glass rind pieces highly altered
Station ID		**A127-299-DR55**					10/13/92
13:05	33	43.466	37	46.184	3857		in water
13:10						150	pinger on, with bag of cups
14:14	33	43.345	37	46.842		3955	on bottom
14:38	33	43.638	37	47.063	3736	3981	a few nibbles
14:57	33	43.613	37	47.228	3736		off bottom
15:55							pinger off
16:00		42.936		48.140	3693		on deck
							40 kg very fresh glassy pieces of pillows
							+very fresh glass (some kg)

FAZAR — A II, cruise 127 Free Fall Core Report, including combined Rock Core Stations

Station ID	Date	Time GMT	Lat °N	Lat'	Lon °W	Long'	Depth meters	Logistics	Modifications	Comments
A127-008-FF1	5-Sep-92	13:24	33	20.52	39	8 478	2102	in water	None	Calm seas, no wind
"Flying Fish"		14:10						at surface		1gm. of glass recovered
		14:20						on deck		
A127-008-FF2	5-Sep-92	13:35	33	20.62	39	8 489	2103	in water	None	Calm seas, no wind
"Daisy"		14:55						no return		
A127-027-FF3	8-Sep-92	10:22	34	22.6	37	5.533	2954	in water	None	1 to 3 ft. seas, light wind
"Flying Fish"		11:29	34	22.48	37	5.694	2949	on deck		glass: 0.3 gm. fairly fresh
A127-028-FF4	8-Sep-92	10:38	34	23.1	37	5.238	2855	in water	None	1 to 3 ft. seas, light wind
"Iggy"		11:59	34	22.49	37	5.705	2950	at surface		glass: 0.3 gm. alt. glass
		12:07	34	22.66	37	5.493	2999	on deck		
A127-029-FF5	8-Sep-92	12:39	34	26.1'	37	4.207	2903	in water	Shorter cables on	Calm seas, no wind
"Iggy"		15:00						no return	balast release system	
A127-030-FF6	8-Sep-92	12:50	34	26.9	37	3.76	2795	in water	Shorter cables on	Calm seas, no wind
"Flying Fish"		14:20						on deck	balast release system	1 mg. of glass
A127-038-FF7	9-Sep-92	9:44	34	46.88	36	27.74		in water	Rounded slip pins &	SEABEAM off, no depth, Seas calm
"Flying Fish"		10:58	34	46.56	36	27.99		on deck	hinges on balast release	Sediment & glass chips, 1gm.
A127-039-RC13	09 Sep 92	10:01	34	47.184	36	27.762		in water		SEABEAM off
ROCK CORE		10:18	34	47.170	36	27.781	2283	hit bottom		Wire out = 2335m.
		10:38	34	46.901	36	27.669	2263	on deck		glass; (0.2 g + 0.4 g in sed.)

Station ID	Date	Time	Lat	Lat'	Lon	Long'	Depth	Logistics	Modifications	Comments
		GMT	°N		°W		meters			
A127-040-FF8	9-Sep-92	11:55	34	53.89	36	25.71	2137	in water	Cable guides added	Calm seas, no wind
"Flying Fish"								no return	Cable placement changed	
A127-041-RC14	09 Sep 92	12:12	34	54.227	36	25.530	2177	in water		
ROCK CORE		12:27	34	54.250	36	25.435	2224	hit bottom		Wire out = 2220m.
		12:46	34	54.080	36	25 450	2198	on deck		(1 g of fresh glass)
A127-092-FF9	14-Sep-92	16:53	37	13.47	32	19.2	2217	in water	U-clamp to replace	Balast pre-tripped first time,
"Sagar"		17:13	37	13 48	32	19.19	2211	2nd try	slip-pin release system	deployed successfully, 2nd time
		18:27	37	13.6	32	19.18	2179	no return		
A127-092-RC40	14 Sep 92	17:31	37	13.036	32	18.943	2176	in water		
ROCK CORE		17:46	37	13.061	32	18.944	2175	hit bottom		Wire out = 2200m.
		18:06	37	13.104	32	18.947	2171	on deck		glass with many plag. crystals
									* Model 2 *	
FAZAR	**LEG 2**								U-Clamp release, short	**FAZAR LEG 2**
									cables, longer core barrel	
									detachable base, 4 door	
									ballast release	
A127-203-FF10	03 Oct 92	12:04	37	20.189	32	16.240	2051	in water	None	Calm seas, no wind
"Baby Cakes"		13:30	37	19.903	32	15.430	2119	on deck		No sample, pre trip or bad hit
A127-204-RC109	03 Oct 92	12:28	37	20.458	32	16.151	2125	in water		
ROCK CORE		12:42	37	20.473	32	16.197	2126	hit bottom		Wire out = 2147m.
		12:59	37	20.572	32	16.104	2148	on deck		sediment; glass (500 mg
										altered) + basalt fragments
A127-205-FF11	3-Oct-92	14.01	37	21 57	32	15.67	2205	in water	None	Calm seas, no wind
"Baby Cakes"		15:07						on deck		1mg of glass found on balast
										box, Sideways hit.
A127-206-RC110	03 Oct 92	14:07	37	21.550	32	15.786	2205	in water		
ROCK CORE		14.22	37	21.563	32	15.730	2210	hit bottom		Wire out = 2213m.
		14:40						on deck		4 g glass slightly altered

Station ID	Date	Time	Lat	Lat'	Lon	Long'	Depth	Logistics	Modifications	Comments
		GMT	°N		°W		meters			
A127-212-FF12	4-Oct-92	11:23	37	25.7	32	14.61	2838	in water	Add lead tc tip of core	3 to 5 ft. seas, 15k winds
"Baby Cakes"		12:58	37	25.77	32	14.79	2871	no return	barrel	
A127-212-RC114	04 Oct 92	11:29	37	25.670	32	14.615	2834	in water		
ROCK CORE		11:49	37	25.677	32	14.645	2839	hit bottom		Wire out = 2884m.
		12:12	37	25.696	32	14.644	2839	on deck		sediment; glass for probe
A127-239-FF13	07 Oct 92	15:20	36	23.769	33	39.743	2662	in water	None	1 to 3 ft. seas, low winds
"Wave Rider"		16.28	36	23.713	33	39.793	2650	at surface		3gm basalt chip & glass
		15:35	36	23.984	33	39.926	2675	on deck		
A127-240-RC125	07 Oct 92	15:24	36	23.713	33	39.730	2645	in water		
ROCK CORE		15:47	36	23.806	33	39.694	2636	hit bottom		Wire out = 2670m.
		16:05	36	24.073	33	39.748	2683	on deck		about 5 g fresh glass
A127-250-FF14	08 Oct 92	13:57	36	29.644	33	39.050	2706	in water	None	calm seas, no wind
		14:13	36	29.61	33	38.98	2701	2nd try		pre-tripped
								no return		
A127-252-RC129	08 Oct 92	14:53	36	30.070	33	39.020	2737	in water		
ROCK CORE		15.13	36	30.152	33	39.063	2738	hit bottom		Wire out = 2767m.
		15:33	36	30.080	33	38.890	2716	on deck		sediment

Appendix 3. INVENTORY DR1-55

Sample Name	Type	Desription	Sieved & Cleaned	Picked Probe	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt (g)
DR01-1		?									
DR01-2		?	+	+	+	+	1	4	+	+	20
DR01-3		?	+	+	+			2	+	+	20
DR01-4		?	+	+	+			1.5	+	+	10
DR01-5		?	+	+	+			2	+	+	10
DR01-6		?	+	+	+			2	+	+	12
DR01-7		?	+	+	+			2	+	+	12
DR02-3	I	gls+x'l	+	+	+			2	+	+	8
DR02-4	I	gls+x'l	+	+	+			2	+	+	12
DR03-1A	V	gls	+	+	+	+	2	8	+	+	400
DR03-1B	V	gls	+	+	+			50	+	+	300
DR03-2A	I	gls	+	+	+	+	1	4	+	+	20
DR03-2B	I	gls	+	+	+	+	1				
DR03-3A	III	gls	+	+	+	+	2	4	+	+	25
DR03-4A	IV	gls	+	+	+				+	-	0.5g
DR03-4B	IV	gls						2	+	+	8
DR03-5	II	gls	+	+	+	+	2	3	+	+	80
DR03-9	I	gls	+	+	+			2	+	-	15
DR03-10	I	gls	+	+	+			2	+	+	50
DR04-1	I	gls+x'l	+	+	+	+	1		+		
DR04-2	I	gls+x'l	+	+	+	+	3	30	+	+	120
DR04-4	II	gls+x'l	+	+	+	+	2	8	+		60
DR04-6	IV	gls+x'l	+	+	+	+	2	1	+		2.5
DR04-7	IV	gls+x'l	+	+	+	+	3	2	+		6
DR04-8	V	gls	+	+	+			1	+		3
DR04-9	VI	gls+x'l	+	+	+	+	3	1	+		3
DR05-1	I	rox+gls	+	+				?	+	+	60
DR05-5	IV	gls+rox	+	+	+	+	3	8	+		15
DR05-6	II	gls+rox+x'l	+	+	+	+	2 or 3	10	+		25
DR05-7	III	gls+rox	+	+				5	+		15
DR05-8	V	gls+x'l	+	+	+	+	8	20	+		30
DR05-9	VI	gls+x'l	+	+	+	+	4	5	+		10
DR06-1	I	rox						0			0.5
DR06-2	I	rox						0			2
DR06-3	II	pumice						0			0.5
DR06-4	III	rox						0			0.5
DR07-1	I	gls	+	+	+	+	2	15	+		70
DR07-2	II	gls	+	+	+	+	2	20	+	+	100
DR07-4	III	gls	+	+	+	+	3	20	+	+	80
DR07-6	VII	gls	+	+	+	+	3	15	+	+	100
DR07-10	IV	gls	+	+	+	+	3	40	+		100
DR07-12	VI	gls+x'l+altr'n	+	+				15	+	+	80
DR08-2	II	gls+rox	+	+	+	+	3	20	+		50
DR08-5	IV	rox+gls	+	+	+	+	4	10	+		30
DR08-6	V	gls	+	+	+	+	4	6	+		15

Sample Name	Type	Desription	Sieved & Cleaned	Picked Probe	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass	Fine Fraction	Coarse Fraction	Total Wt (g)
DR09-7	III	gls	+	+				1	+		2
DR09-8	IV	altr'd gls	+	+				1.5	+		5
DR09-10	VI	gls	+	+				3	+		8
DR09-13	VIII	rox								+	
DR10-1	I	rox+(gls)	+	+	+			0.2	+	+	40
DR10-2A	II	gls+rox	+	+	+			6	+	+	20
DR10-2B	II	rox+(gls)						0			4
DR10-4A	III	gls+rox	+	+	+		6	2	+	+	15
DR10-4B	III	gls+rox	+	+	+	+		2	+	+	10
DR10-6	IV	gls	+	+	+	+	4	1	+		12
DR10-7	V	gls+x'l	+	+	+			15	+	+	120
DR10-9	VI	gls+x'l	+					20	+	+	50
DR10-10	VII	gls+rox	+	+	+			4	+	+	12
DR11-1	I	gls	+	+	+	+	6	15	+	+	150
DR11-4	II	gls	+	+	+	+	11	10	+	+	100
DR11-6	III	gls	+	+	+	+	4	5	+		20
DR12-1A	I	gls+rox	+	+	+	+	9	8			25
DR12-5	V	gls	+	+	+	+	4	1	+		2
DR13-1	II	gls+x'l	+	+	+	+	8	15	+	+	50
DR13-3	III	gls	+	+	+			6	+	+	30
DR13-6	SG	gls	+	+	+			3	+		6
DR13-8	IV	gls+rox	+	+	+			5	+		10
DR13-14	I	gls+rox	+	+	+	+	6	20	+	+	100
DR14-1	I	altr'd gls	+	+				2	+		8
DR14-2	II	altr'd gls	+	+	+	+	8	8	+	+	20
DR14-5	IV	altr'n									2
DR015-1	I	gls	+	+	+	+	5	1		+	30
DR015-2	II	gls	+	+	+	+	9	10	+	+	30
DR015-6	III	altr'd gls						0			25
DR016-1	I	altr'd gls	+	+				4	+	+	40
DR016-1		rox	+	+	+	+	16	3	+	+	10
DR017-1	I	gls+rox+x'l	+	+	+	+	8	15	+		50
DR017-3	II	gls+rox+x'l	+	+	+	+	9	10	+		40
DR017-5	III	gls+rox	+	+	+	+	9	4	+		10
DR018-1	I	gls+x'l	+	+				6	+		12
DR018-4	III	gls	+	+				1.5	+		3
DR19-1	I	altr'd gls	+	+	+	+	7	10	+	+	30
DR21-1	I	gls	+	+	+	+	6	2		+	25
DR21-3	I	gls	+	+	+	+	9	15	+	+	100
DR21-5	II	gls	+	+	+	+	9	8	+		15
DR22-1	I	gls	+	+	+	+		10	+	+	50
DR22-5	II	gls	+	+	+	+	9	6	+	+	100
DR22-6	III	gls	+	+	+	+	7	10	+	+	150
DR22-7	SG	gls	+	+	+	+	7	4	+	+	30
DR24-1	I	gls	+	+	+	+	9	1	+	+	20
DR24-2	II	gls	+	+	+	+	13	3	+	+	10
DR24-?		sedt									0.002

Sample Name	Type	Desription	Sieved & Cleaned	Picked Probe	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass	Fine Fraction	Coarse Fraction	Total Wt (g)
DR25-1	IV	gls	+	+	Lamont-II			0.05	+	+	
DR25-2	IV	gls	+	+	Lamont-II			0.05			
DR26-1	I	gls	+	+	+	+	10	8	+	+	15
DR26-2	I	gls	+	+	+	+	11	5	+	+	10
DR26-3	I	gls	+	+				1.5	+	+	8
DR26-4	II										
DR26-5	SG	gls	+	+	+	+	11	5	+	+	10
DR26-6	SG	gls	+	+				4	+	+	8
DR26-7	SG	gls	+	+	Lamont-II			4	+	+	?
DR26-8	SG										
DR27-1	I										
DR27-2	I	gls	+	+				10	+	+	35
DR27-3	I	gls	+	+	+	+	11	6	+	+	70
DR27-4	II	gls	+		+	+	11	6	+	+	70
DR27-5	II	gls	+	+	+	+	11	3	+	+	30
DR27-6	SG	gls	+	+	+	+	11	2	+	+	5
DR27-7	SG	gls	+	+				2	+	+	5
DR27-?	pumice										
DR29-1	SG	gls	+	+	+	+	11	4	+	+	9
DR29-2	SG	gls	+	+	+	+	10	4	+	+	8
DR29-3	SG	gls	+					3	+	+	7
DR29-He	SG	gls									15
DR30-1	I	gls+rox									50
DR30-2	I	gls+rox	+	+	Lamont-I			20	+	+	35
DR30-3	I	gls+rox	+	+	Lamont-II			10	+	+	100
DR30-4	I	gls+rox									100
DR32-1		pumice									5
DR32-2		mud									1
DR32-3		carb ooze									0.5
DR32-shells		shells									0.5
DR33-2		alt'd gls	+	+	Lamont-I			4	+	+	7
DR33-3		rox+gls									10
DR33-8		mud									1
DR34-2	II	alt'd gls	+	+				8	+	+	100
DR34-7	III	gls	+	+	Lamont-I			7	+	+	60
DR34-9	SG	alt'd gls	+	+	Lamont-II			6	+	-	5
DR34-10	SG	alt'd gls									5
DR35-1	I	gls+xls	+	+	+	+	15	12	+	+	100
DR35-2	I	gls+rox									4
DR35-3	II	?	+	+	Lamont-II			0.1			0.1
DR36-3	II	gls+rox+pl									20
DR36-4	II	gls+rox									10
DR36-5	II	rox									70
DR36-6	III	gls+altr'n									20
DR36-9	V	gls+altr'n									15
DR36-11	VII	gls	+	+				6	+	+	16
DR36-12	VII	gls+rox	+	+	+	+	14	5	+	+	22

Sample Name	Type	Desription	Sieved & Cleaned	Picked Probe	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass	Fine Fraction	Coarse Fraction	Total Wt (g)
DR36-13	VII	gls rind									50
DR36-14	VII	gls rind									50
DR36-15	VII	gls rind									50
DR36-16	VIII	gls+rox									7
DR36-17	IX	gls+rox	+	+	+	+	14	5	+	+	16
DR36-18	IX	gls+rox									8
DR36-19	X	gls+rox	+	+	+			3.5	+	+	15
DR36-20	X	gls+rox	+	+	+	+	13	12	+	+	25
DR36-21	X	gls+rox									20
DR36-22	X	gls+rox									7
DR36-23	XI	gls+rox									30
DR36-24	XII	gls+rox	+	+	+	+	14	5	+	+	25
DR36-25	XII	gls									10
DR36-26	XII	gls									10
DR36-27	XII	gls									5
DR36-28	XII	gls									4
DR36-29	XII	gls	+	+				2.5	+	+	4
DR37-1	I	pl+gl+rox	+	+	+	+	13	12	+	+	100
DR37-2	I	pl+gl+rox									6
DR37-3	I	pl+gl+rox	+	+				8	+	-	2.5
DR38-1	I	rox									100
DR38-2	II-1	alt'r rind									60
DR38-3	II-1	alt'd gls	+	+				7	+	+	20
DR38-4	II-2	gls+plag	+	+	Lamont-I			8	+	+	15
DR40-1	I	gls+rox									
DR40-2	I	gls+rox									
DR40-3	I	gls+rox	+	+	Lamont-I			9	+	+	20
DR40-4	II	gls	+	+	+	+	14	12	+	+	25
DR40-5	III	gls	+	+	Lamont-II			8	+	+	30
DR40-6	IV	gls	+	+	+	+	15	6	+	+	15
DR40-7	V	gls	+	+	Lamont-I			8	+	+	15
DR41-1	I	alt'd gls	+	+	Lamont-II			4	+	+	8
DR41-2	I	alt'd gls	+	+				3	+	-	6
DR41-3	I	alt'd gls	+	+	Lamont-II			1.5	+	+	3
DR43-1	I	alt'd gls	+	+	+	+	15	10	+	+	25
DR43-2	I	alt'd gls									25
DR43-3	II	sedt									20
DR43-3A	II	coarse sedt	+	+				0.1	-	+	5
DR43-3B	II	fine sedt									200
DR44-1	I	gls	+	+	+	+	15	10	+	+	100
DR44-2	I	gls									80
DR44-3	V	gls	+	+	Lamont-II			5	+	+	45
DR44-4	II	gls									12
DR44-5	II	gls+rox	+	+	Lamont-II			8	+	+	17
DR44-6	III	gls+rox	+	+	Lamont-II			4	+	+	19
DR44-7	IV	gls+rox	+	+	Lamont-II			3	+	+	8
DR44-8	SG	gls	+	+	+	+	15	4	+	+	10

Sample Name	Type	Desription	Sieved & Cleaned	Picked Probe	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass	Fine Fraction	Coarse Fraction	Total Wt (g)
DR44-9	SG	gls rind									10
DR44-10	VI	gls+rox	+	+	Lamont-II			8	+	+	14
DR45-1	I	gls+xls	+	+	Lamont-II			8	+	+	13
DR45-2	II	gls+xls	+	+	Lamont-II			15	+	+	80
DR45-3	VI	gls+xls	+	+	Lamont-II			8	+	+	38
DR45-4	III	gls+xls	+	+	Lamont-I			10	+	+	100
DR45-5	IV	gls+xls	+	+	Lamont-I			15	+	+	85
DR45-6	V	gls+xls									15
DR45-7	SG	gls+xls	+	+	+	+	15	12	+	+	27
DR45-8	I	gls+xls									7
DR46-1	I	gls+altr'n									20
DR46-2	I	gls+altr'n									15
DR46-3	I	gls+rox	+	+	Lamont-I			4	+	+	9
DR46-4	II	gls+rox	+	+	Lamont-II			4	+	+	16
DR46-5A	III	ves, alt'd gls									15
DR46-5B	III	ves, alt'd gls									6
DR46-5C	III	ves, alt'd gls									8
DR46-5D	III	ves, alt'd gls	+	+	Lamont-II			6	+	+	16
DR46-5E	III	ves, alt'd gls									8
DR46-6	IV	gls									3
DR46-7	IV	gls	+	+	Lamont-I			8	+	+	14
DR46-8	IV	ves gls									2
DR46-SG	IV	ves gls									10
DR47-1	I	bio sand									150
DR48-1		rox+gls	+	+	Lamont-II			1.5	+	-	2
DR49-1	I	gls+plag	+	+	Lamont-I			15	+	+	75
DR49-3	III	gls+plag	+	+	+	+	15	10	+	+	30
DR50-1	I	gls+altr'n	+	+	Lamont-I			6	+	+	16
DR50-2	II	gls+rox	+	+	+	+	15	6	+	-	10
DR50-3	II	gls rind									15
DR50-4	III	ves gls	+	+	Lamont-II			0.5	+	+	1.5
DR50-5	IV	ves gls	+	+	Lamont-II			1.5	+	+	3.5
DR50-6	VII	gls	+	+	Lamont-II			8	+	+	16
DR51-4	IV	forams									150
DR52-2	I	rox+gls	+	+	Lamont-II			15	+	+	115
DR52-3	II	gls+plag	+	+	Lamont-I			17	+	+	37
DR52-4	II	rox+gls									25
DR52-5	III	sedt									80
DR53-1	II	gls+plag	+	+	Lamont-I			8	+	+	18
DR53-2	II	gls+plag									12
DR53-3	I	gls+pl+rox	+	+	Lamont-II			1.5	+	+	5
DR53-4		sedt									3
DR54-1	I	alt'd gls	+	+	Lamont-I			8	+	+	200
DR54-2	I	gls+rox									10
DR54-3	II	gls+rox	+	+	Lamont-II			6	+	+	14
DR54-5	IV	alt'd gls	+	+	Lamont-II			4	+	+	19
DR55-1B	I	fresh gls	+	+	+	+	15	12	+	+	65

Sample Name	Type	Desription	Sieved & Cleaned	Picked Probe	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass	Fine Fraction	Coarse Fraction	Total Wt (g)
DR55-2B	I	fresh gls	+	+	Lamont-I			13	+	+	38
DR55-3	II	gls+rox	+	+	Lamont-I			13	+	+	53
DR55-4A	III	gls+rox									40
DR55-5	III	gls	+	+	Lamont-I			10	+	+	50
DR55-SG		gls									15
	Explanation: gls=glass,rox=rock,altr'n=alteration, sedt+sediment; xl = phenocryst; ves=vesicles										
		Lamont-I = Dredge samples picked for plasma to run at Lamont (completes one per dredge)									
		Lamont-II = Dredges samples not yet picked for plasma (would complete one per type)									
		SG = station glass									

Appendix 4. ROCK CORE INVENTORY

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC01	gls+X'l	+	+	7	+	-		10mg	-	-	
RC01-2	sedt							0			5
RC02	gls+X'l	+	+	7	+	+	1	100mg	-	-	5
RC03	gls	+	+	7	+	+	1	0	-	-	0.75
RC04	gls+x'l	+	+	7	+	+	2	0	-	-	17
RC05	gls+sedt	+	+	7	+	-		150mg	+	-	0.5
RC06	gls	+	+	7	+	+	12	300mg	+	+	1.5
RC07	gls+x'l	+	+	7	+	+	12	0	-	-	1.5
RC07-S	gls+sedt								-	-	0.5
RC08	gls	+	+	7	+	+	4	0	-	-	17
RC09	gls	-	+	7	-	-		0	-	-	0.6
RC10	gls		+	7							0.005
RC11	gls+x'l+rox	+	+	7	+	+	4	0	-	-	15
RC12	sedt (+ gls?)	-	+	7	-	-					0
RC13	gls	+	+	7	-	-		0	-	-	0.1
RC13-S	gls from sedt	+	+	8				0.5g	-	-	0.5
RC13-2	sedt										0.05
RC14	gls+x'l+rox	+	+	8	+	+	5	200mg	-	-	7
RC15	gls+altr'n	-	+	8	-	-		0	-	+	0.01
RC16	gls	+	+	8				3g	+	-	13
RC16-A	gls+altr'n	+	+	8	+	-		0.5g	+	+	7
RC17	gls	+	+	8	+	+	4	3g	-	-	3
RC17-S	sedt+gls										5
RC18	gls+rox+x'l	+	+	8	+	+	12	100mg	+	+	7
RC18-S	sedt+gls(?)										6
RC19	rox	-	+	8	-	-		0	-	-	20
RC20	gls+(rox)	+	+	8	+	+	5	0	-	-	20
RC21	glassy rox	-	+	8	-	-		0	-	-	0.5
RC22	rox	-	+	8	-	-		0	-	-	0.005
RC23	gls	+	+	8	+	+	6	0	-	-	0.5
RC24	gls+altr'n	+	+	8	+	+	6	4g	+	-	1.5
RC24A	gls										2
RC25	sedt							0			30
RC26	gls+x'l	+	+	8	+	+	6	0	-	-	15
RC26-S	gls from sedt		+	8				0	-	-	0.02

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC26-2	sedt (fines)							0	+	-	30
RC26-3	sedt										20
RC27	gls	+	+	9	+	+	5	0	-	-	3.5
RC28	gls	+	+	9	+	+	5	0	-	-	2
RC28-2	sedt										2
RC29	gls	+	+	9	+	+	10	0.5g	-	-	1
RC30	gls	+	+	9	+	+	5	0	-	-	2.5
RC30-2	sedt							0			1
RC31	gls	+	+	9	+	+	6	0	-	-	10
RC31-S	sedt		+	9				0	-	-	2
RC32	gls+rox	+	+	9	+	+	5	0	-	-	15
RC32-2	sedt										5
RC33-S	gls from sedt	-	+	9	-	-		0			5
RC33-2	sedt								+	-	40
RC33-3	sedt										5
RC34	gls+x'l	+	+	9	+	+	5	0	-	-	15
RC35	gls+x'l	+	+	9	+	+	6	0	-	-	15
RC35A	gls										2
RC36	gls	+	+	9	+	+	7	6g	+	-	15
RC36-2	sedt										25
RC37	gls	+	+	9	+	+	8	2g	+	-	2
RC38	gls	+	+	9	+	+	7	7g	+	-	16
RC38-2	sedt										15
RC39	gls	-	+	9	-	-		200mg	+	-	1
RC40	gls+x'l	+	+	10	+	+	8	2g	+	+	6
RC41	rox+x'l	+	+	10	-	-		1g	-	-	12
RC42	rox +altr'n	+	+	10	-	-		10-20mg	-	-	0.5
RC43-1	rox+gls	-	+	10	-	-		10mg	-	-	1
RC43-2	sedt+gls	-	-		-	-		0	-	-	2
RC43-3	sedt	-	-		-	-		0	+	-	1
RC44	rox+x'l+gls	+	+	10	-	-		10-20mg	-	-	10
RC44-2	sedt							0	-	-	25
RC45	altr'n+gls	+	+	10	-	-		20mg	+	-	1
RC45-2	sedt							0	-	-	2
RC46	gls	+	+	10	+	+	8	6g	+	-	15

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC47	rox+altr'n	+	+	10	-	-		0	-	-	1
RC47-2	sedt							0	-	-	1
RC48	gls+x'l	+	+	10	+	+	7	4g	+	-	12
RC48-2	sedt							0	-	-	1.5
RC49	gls+altr'n	+	+	10	+	+	8	1.5g	-	-	1.5
RC49-2	sedt							0	-	-	15
RC50	gls+altr'n	+	+	10	-	-		0	+	-	0.1
RC50-2	sedt							0	-	-	12
RC51	rox+gls	+	+	10	-	-		5mg	-	-	2
RC51-2	sedt							0	-	-	10
RC52-1	sedt	-	-		-	-		0			15
RC52-2	carbonate	-	-		-	-		0			2
RC53	rox+altr'n	-	-		-	-		0	-	-	40
RC54	sedt+alt'd rox	-	-		-	-		0			20
RC55	sedt +rox	-	+	10	-	-		0	+	-	30
RC56	rox+x'l	+	+	10	-	-		0	+	-	5
RC57	gls from sedt	-	+	10	-	-		0	-	-	2
RC57-2	sedt							0	+	-	5
RC58	gls+rox	-	+	11	+	+	8	0	+	+	5
RC59	gls	+	+	11	+	+	8	2g	+	-	5
RC60	rox+x'l	+	+	11	-	-		10mg	+	-	8
RC61	rox+sedt	+	+	11	-	-		0	+	-	20
RC62A	gls	+	+	11	-	-		~0	-	-	0.02
RC62A-2	sedt							0	-	-	20
RC63	gls	+	+	18, 7	+	+	7	3g	+	-	8
RC64	gls	+	+	11	+	+	7	2g	+	-	5
RC65	gls	+	+	11	+	+	8	3g	+	-	10
RC66	gls	+	+	11	+	+	7	7g	+	-	15
RC67	gls+altr'n	+	+	11	+	+	9	1.5g	-	-	5
RC68	altr'n+gls	+	+	11	-	-		0.075	+	-	0.5
RC69	gls+x'l+rox	+	+	11	+	+	10	1g	+	+	15
RC70-1	gls	+	+	11	+	+	10	1.5g	-	-	8
RC70-2	sedt+gls	Acid	+	11	-	-		0.1			0.1
RC71-1	gls	+	+	12	-	-		50mg	+	+	1.5
RC71-2	sedt							0	-	-	3

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC71-3	gls	+	+	12	+	+		50mg	+	+	2
RC71-4	sedt							0	+	-	15
RC72	gls	+	+	12	+	+	10	2g	+	+	20
RC73	gls+altr'n	+	+	12	+	+	13	3g	+	+	6
RC74	gls+x'l+altr'n	+	+	12	+	+	14	3g	+	+	6
RC75-1	sedt	-	-		-	-					5
RC75-2	gls from sedt	Acid	+	12	-	-		0.05			0.05
RC75-3	sedt							0	+	-	4
RC76-1	gls	+	+	12	+	-		<50mg			0.025
RC76-2	sedt							0			4
RC76-3	gls	+	+	12	+	-		20mg	-	+	3
RC76-4	sedt							0	+	-	10
RC77-1	gls	+	+	12	+	+	10	2g	+	+	10
RC77-2	sedt							0			4
RC77-3	gls from sedt	+	+	12	-	-		50mg	-	+	1
RC77-4	sedt							0	+	-	4
RC78-1	gls+ rox	+	+	12	+	+	10	5g	+	+	30
RC78-2	sedt							0			0.5
RC78-3	gls from sedt	+	+	12	-	-		0.05	-	+	0.05
RC78-4	sedt							0	+	-	0.5
RC79	gls	+	+	12	+	+	13	1g	+	+	2
RC79-2	gls in sedt										0.05
RC80	gls	+	+	17	(Lamont)	-		1.5	+	+	3.5
RC81	gls+ altr'n	+	+	12,13	+	+	13	3g	+	+	7
RC82-1	gls+ altr'n	+	+	13	+	+	12	4g	+	+	16
RC82-2	sedt										10
RC82-3	gls in sedt								-	+	0.5
RC82-4	sedt								+	-	5
RC83-1	gls+ rox	+	+	13	+	+	13	3g	+	+	15
RC83-2	sedt										0.3
RC83-3	gls from sedt	+	+	13	-	-		0.5g	-	+	1
RC83-4	sedt								+	-	1
RC84	gls	+	+	13	+	+	10	4g	+	+	40
RC85-1	gls	+	+	13	+	+	12	3g	+	+	7
RC85-2	sedt										0.5

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC85-3	gls in sedt	+	+	13	-	-		0.3g	-	+	1
RC85-4	sedt								+	-	1
RC86	gls	+	+	13	+	+	12	1.5g	-	-	10
RC87	gls+rox	+	+	13	+	+	12	3g	+	+	10
RC88	rox+gls+altr'	+	+	13	+	+	12	1.5g	-	-	6
RC89	gls	+	+	13	+	+	10	2.5g	+	+	20
RC90	gls	+	+	13	+	+	10	3.5g	-	-	20
RC91-1	gls	+	+	13				1.5	-	-	10
RC91-2	sedt										1
RC91-3	gls in sedt	+	+	13				0.03	-	+	2
RC91-4	sedt								+	-	1
RC92-1	coral										100
RC92-2	coral										100
RC93-1	gls	+	+	14	+	+	11	2	+	+	6
RC93-2	gls from sed	+	+	14				0.2	+	+	2
RC93-3	sedt										3
RC94-1	rox+gl	+	+	14				0	-	-	1
RC94-2	sedt										0.05
RC95	rox+gls	+	+	14				0.7	+	+	2
RC96-1	breccia										1
RC96-2	breccia	+	+	14				0.1	+	+	10
RC96-3	sedt/matrix										0.2
RC97-1	breccia										1
RC97-2	breccia	+	+	14				0.2	+	+	30
RC97-3	sedt/matrix										1
RC98	gls	+	+	14	+	+	11	3.5	+	+	30
RC99	rox+gls	+	+	14				1.5	+	+	3
RC100	rox+gls	+	+	14				0.7	+	+	3
RC101-1	gls+altr'n	+	+	18				2	+	+	8
RC101-2	sedt										0.1
RC101-3	gls+ sedt	+	+	14				0		+	1
RC101-4	sedt								+		1
RC102-1	coral										10
RC102-2	sedt										1
RC102-3	gls from sedt	+	+	14				10mg		+	2

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC102-4	sedt								+		2
RC103-1	gls	+	+	17	(Lamont)			2	+	+	4
RC103-2	gls from sedt	+	+	14				0.3			2
RC104-1	gls	+	+	14	+	+	12	0.5	+	+	3
RC104-2	gls from sedt	+	+	14				0.2			1
RC105-1	rox+gls	+	+	15				2	+	+	15
RC105-2	rox+gls in se	+	+	15	+	+	12	4	+	+	10
RC105-3	sedt								+	-	1
RC106-1	gls	Acid	+	15				3.5			3.5
RC106-2	coarse sedt										0.5
RC106-3	fine sedt										0.06
RC107	gls	+	+	15	+	+	13	1.5	+	+	15
RC108-1	gls	+	+	15	+	+	13	1.5	+	+	15
RC108-2	sedt										0.3
RC108-3	coarse	+	+	15				0.02	-	+	0.3
RC108-4	fine								+	-	2
RC109-1	gls	+	+	17				0.2	+	+	1
RC109-2	sedt										0.2
RC109-3	coarse sedt	Acid	+	15				0.01	-	+	0.05
RC109-4	fine sedt								+	-	1
RC110	gls+plag	+	+	15, 19	+	+	15	6	+	-	9
RC111-1	gls	+	+	17	(Lamont)			1	+	+	3
RC111-2	fine sedt										4
RC111-3	coarse sed		could be								1.5
RC112-1	gls+xls	+	+	15				0.7	+	-	1.5
RC112-2	sedt										0.5
RC112-3	coarse sedt		could be						-	+	0.4
RC112-4	fine sedt								+	-	0.5
RC113-1	gls+xls+altr'r	+	+	18	+			1.5	+	+	7
RC113-2	sedt										0.2
RC113-3	coarse sedt		could be								0.5
RC113-4	fine sedt										0.5
RC114-1	gls specks	+	+	15				0.01	-	-	0.01
RC114-2	coarse sedt							0	-	+	0.05
RC114-3	fine sedt								+	-	0.2

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC115	rock							0			50
RC116-1	rox,gls,xls	+	+	15				0.7	+	+	2
RC116-2	rox,gls,xls	+	+	15	+	+	14	15	+	+	100
RC117-1	gls, xls, altr'n	+	+	15	+	+	14	1.5	+	+	12
RC117-2	caorse sedt		could be						-	+	
RC117-3	fine sedt								+	-	0.3
RC118-1	gls	+	+	15				0.5			3
RC118-2	sedt										0.75
RC118-3	coarse sedt		could be								0.2
RC118-4	fine sedt										1.5
RC119	gls	+	+	16	+	+	13	2.5	+	+	6
RC120-1	gls+rock	+	+	16	+	+	14	2	+	+	15
RC120-2	coarse sedt		could be					0.05	-	+	0.05
RC120-3	fine sedt								+	-	0.2
RC121-1	coarse sedt	+	+	16	-			0.01	-	+	1
RC121-2	fine sedt								+	-	5
RC122-1	coarse sedt	+	+	16	-			0.5	-	+	2.5
RC122-2	fine sedt								+	-	15
RC123-1	coarse sedt	Acid	+	16				0.01	-	+	0.05
RC123-2	fine sedt								+	-	1.5
RC124-1	sedt										0.75
RC124-2	coarse sedt	+	+	16	-			0	-	+	0.3
RC124-3	fine sedt								+	-	2.5
RC125-1	gls	+	+	16	(Lamont)			2.5	+	+	5
RC125-2	sedt										0.5
RC125-3	coarse sedt							0	-	+	0.7
RC125-4	fine sedt								+	-	0.5
RC126-1	coarse sedt	+	+	16	-			0.1	-	+	1
RC126-2	sedt										0.4
RC126-3	fine sedt								+	-	2
RC126-4	ship paint										0.1
RC127-1	coarse sedt	+	+	16	-			0	-	+	0.75
RC127-2	sedt										1
RC127-3	fine sedt								+	-	5
RC128-1	gls+xls	+	+	19	(Lamont)			2.5	+	+	6

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC128-2	sedt										0.5
RC128-3	coarse sedt	Acid	+	16				0.01	+	-	0.02
RC128-4	fine sedt								-	+	0.5
RC129-1	sedt										1.5
RC129-2	coarse sedt	Acid	+	16				0.01	-	+	0.03
RC129-3	fine sedt								+	-	5
RC130-1	gls	+	+	16	+	+	14	2.5	+	-	5
RC130-2	gls +sedt		could be								2.5
RC131	gls+rox	+	+	16				0.2			0.7
RC132	gls		+	16				0			0
RC133	gls+x'l	+	+	17	(Lamont)			6	+	+	15
RC134A	gls from deck	+	+	17	(Lamont)			1	+		2
RC134	gls	+	+	17				1	+	+	2
RC135-1	gls	+	+	17	(Lamont)			2	+		4
RC135-2	sedt										1
RC135-3	coarse sedt	+	+	17				0.05		+	4
RC135-4	fine sedt								+		5
RC136-1	rox+gls	+	+	19	(Lamont)			2.5	+	+	12
RC136-2	gls+sedt	+	+	17				0.1			1
RC137	gls	+	+	17				1	+	+	2.5
RC138	gls	+	+	17				1			2.5
RC139	gls	+	+	19	(Lamont)			4	+	+	24
RC140	gls +altr'n	+	+	19	(Lamont)			2.5	+	+	12
RC141	gls		+	17				0			0.005
RC142	rox	+	+	18				0.1	+	+	1.5
RC143		+	+	18				0.1			2
RC144	gls	+	+	18	(Lamont)			5	+	+	20
RC145	ship+rox+gls	+	+	18				0.2			1
RC146-1	sedt+gls										1
RC146-2	sedt										2
RC146-3	coarse sedt	Acid	+	18				0.3		+	0.3
RC146-4	fine sedt								+		8
RC147-1	sedt										2
RC147-2	coarse sedt	Acid	+	18						+	0.2
RC147-3	fine sedt								+		5

Sample Name	Desription	Sieved & Cleaned	Picked Probe	Probe Mount#	Picked Plasma	Plasma Run	Batch #	Amount of Clean Glass Separated	Fine Fraction	Coarse Fraction	Total Wt Sample(g)
RC148-1	gls	+	+	18	(Lamont)			4			12
RC148-2	sedt										0.5
RC149	gls+rox	+	+	18	+	+	15	2	+	+	6
RC150	gls+altr'n	+	+	18	(Lamont)			1.5	+		2.5
RC151-1	gls	+	+	18	(Lamont)			5	+	+	15
RC151-2	sedt										6
RC152	gls+rox	+	+	18	(Lamont)			4	+	+	24
	Explanation: gls=glass; rox = rock; altr'n = alteration products; sedt = sediment; x'l = crystals										
	(Lamont) = samples picked for plasma to be run at Lamont										
	Sediment samples were usually subdivided into three samples:										
	1) an aliquot of the original sediment, 2) a coarse fraction, and 3) a fine fraction obtained by "panning"										
	Glass and rock samples were typically seived and into three fractions:										
	1) a coarse fraction (> kitchen seive), 2) a fine fraction (< 750 microns), and 3) the clean chips in between that were used for pi										

Appendix 5. FRENCH SAMPLE SELECTIONS

H. Bougault
List of samples stored at IFREMER

DR01	Glass fragmts					
DR02	DR02-5					
DR03	North of Hayes	40 kg bas. pillow frgmts, glassy rinds; 4 types			NOT SAMPLED	
DR04	North of Hayes	dredge on deck -- plag-phyric andesite			NOT SAMPLED	
	13 kg (1 piece), 6 kg (boulder) + small pieces, some glass					
DR06	mud + 4 small rock chips				NOT SAMPLED	
DR07	DR07-5 type 1	DR07-7 typpe 2	DR07-3 type 3	DR07-8 type 4	DR07-11 type 6	
	DR07-stat. glass					
DR08	DR08-1B	DR08-3	DR08-stat.gl. Type 5			
DR09	DR09-12 T6	DR09-09 T4	DR09-12 T6			
DR10	DR10-3 T2	DR10-05-T3	DR10-08 T5			
DR11	DR11-05 T2	DR11-07 T1	DR11-00 T1			
DR12	DR12-2 T1					
DR13	DR13-2 T1	DR13-2 T2	DR13-4 T3	DR13-7 St Glass	DR13-9 T4	
DR14	North of FAMOUS		5 kg old altered glass		NOT SAMPLED	
DR15	DR15-15 T4	DR15-4 T1	DR15-3	DR15-17 T1	DR15-16 T5	
DR16	DR16-2 T1					
DR17	DR17-6 T3	DR17-2 T1	DR17-4 T2			
DR18	DR18-2 T1					
DR19	95%=2 big boulders				NOT SAMPLED	
	40 kg severely altered aphyric pillow; glass highly palagonized; 1 type					
DR20		NOT SAMPLED	99% corals		NOT SAMPLED	
DR21	DR21-4 T1	DR21-2 T1				
DR22	DR22-4 T1	DR22-2 T1				

DR23	100 kg old vsicular altered basalt, no glass coral, marine life				NOT SAMPLED
DR24	DR24-1				
DR25	unsuccessfull				
DR26	DR26-1	DR26-Glass			
DR27	DR27-1	DR27-rim	DR27-Glass		
DR28	biological dredge; ! rock Mn coating + altered glass fragments				NOT SAMPLED
DR29	DR29-Glass				
DR30	DR30-1				
DR31	Line caught in screws of ship. Sheared off.				
DR32	only few pumice rounded fragments				NOT SAMPLED
DR33	one old pillow fragment, no fresh glass but a piece of altered rind with fresh glassy interior. rest: biology				NOT SAMPLED
DR34	DR34-glass	50 kg old pillow fragments with altered glassy rinds. Basalt is aphyric and slightly vesicular			
DR35	<50 g of material; altered glassy plag phyric rind glass chip inside carbonate ooze				NOT SAMPLED
DR36	DR36-T1	DR36-T2	DR36-T2bis	DR36-T12	
DR37	DR37				
DR38	DR38-T1	DR38-T2-1			
DR39	1 plag. phyric rock, altered; biology				NOT SAMPLED
DR40	DR40-glass				
DR41	9 pieces glassy pillow crust; 1 type				NOT SAMPLED
DR42	DR42-(gl+plag)	DR42-T1			
DR43	flat pieces of very altered glass + sediment				NOT SAMPLED
DR44	DR44-T1	DR44-T2	DR44_StGlass		

DR45	DR45-T1	DR45-T2	DR45-T3	DR45-T5	DR45-StGlass
DR46	DR46-9-T1	DR46-10-T2	DR46-11-T3		
DR47			No rock		
DR48			Unsuccessfull		
DR49	DR49-1	DR49-glass			
DR50	DR50-T2a	DR50-T2b	DR50-T3		
DR51	completely altered pieces of basalt				NOT SAMPLED
DR52	DR52 T1	DR52 T2			
DR53	DR53 T1	DR 53 T2			
DR54	DR54-T2	DR54-T5			
DR55	DR55-T1	DR55-T2	DR55-T3	DR55-st.glass	

Appendix 6. THIN SECTIONS

List of Samples for which THIN SECTION Slices were Made

(A127-FAZAR Expedition)

DR3-1A	DR12-3	DR34-7	DR44-7
DR3-1B	DR12-4	DR36-1	DR44-10
DR3-2	DR13-8	DR36-2	DR45-1
DR3-3A	DR13-14	DR36-3	DR45-2
DR3-4A	DR14-1	DR36-4	DR45-3
DR3-5	DR16-1	DR36-5	DR45-4
DR3-9	DR17-1	DR36-6	DR45-5
DR3-10	DR17-2	DR36-7†	DR45-6
DR4-4	DR17-5	DR36-8†	DR45-8
DR5-1	DR18-1	DR36-9	DR46-1
DR5-5	DR19-1A	DR36-10	DR46-2
DR5-6	DR21-1	DR36-16	DR46-3
DR5-7	DR21-3	DR36-17	DR46-4
DR5-9	DR22-1	DR36-18	DR46-5A
DR7-4	DR22-5	DR36-19	DR46-5B
DR7-12	DR26-1	DR36-20	DR46-5C
DR8-1A	DR26-2	DR36-21	DR46-5D
DR8-2	DR26-3	DR36-22	DR46-5E
DR8-4	DR26-4	DR36-23	DR49-1
DR8-5	DR27-1	DR38-1	DR49-2
DR9-1	DR27-2	DR39-1	DR50-1
DR9-5	DR27-3	DR40-1	DR52-1
DR9-13	DR28-1	DR40-2	DR53-3
DR10-2A	DR30-1	DR40-3	DR54-1
DR10-2B	DR30-2	DR40-4	DR54-2
DR10-4A	DR30-3	DR40-5	DR54-3
DR10-4B	DR30-4	DR44-1	DR54-4
DR10-7	DR33-1	DR44-2	DR55-1B
DR10-9	DR34-3	DR44-3	DR55-2B
DR10-10	DR34-4	DR44-4	DR55-3
DR11-4	DR34-5	DR44-5	DR55-4A
DR12-1A	DR34-6	DR44-6	DR55-5

Appendix 7. BAGGED WORKING SAMPLES

BAGGED Working Samples (Dredges)

(A127-FAZAR Expedition)

Working samples are bagged based on the following "rules":
1. Samples from same dredge are bagged in the same bag.
2. Samples from different dredges may be bagged in the same bag.
3. If 2 is true, samples from sequentially close dredges are bagged together if possible.

Large Bag Number

1	DR3-1A (2 bags); 3-1B (2 bags)
2	DR3-2; 3-3 (A,B,C,D); 3-4; 3-5; 3-9; 3-10; 4-4; 7-4; 7-12
3	DR5-1; 5-5; 5-6; 5-7; 5-9
4	DR18-1; 11-4; 9-1; 9-5; 9-13; 8-1; 8-2; 8-4; 8-5
5	DR10-1; 10-2A; 10-2B; 10-4A; 10-4B; 10-7; 10-9; 10-10
6	DR17-1; 17-3; 17-5; 15-6; 14-1; 13-14; 13-8; 12-1A; 12-3; 12-4
7	DR16-1; 19-1
8	DR28-1; 22-1; 22-5; 21-1; 21-3
9	DR33-1; 38-1; 49-1; 49-2; 50-1; 52-1; 53-3
10	DR26-1; 26-2; 26-3; 26-4
12	DR30-1; 30-2; 30-3; 30-4
13	DR34-3; 34-4; 34-5; 34-6; 34-7
14	DR36-1; 36-2; 36-3; 36-4; 36-5; 36-6; 36-9; 36-10; 36-16; 36-17; 36-18; DR36-19; 36-20; 36-21; 36-22; 36-23
15	DR37
16	DR39-1
17	DR40-1; 40-2; 40-3; 40-4; 40-5
18	DR44-1; 44-2; 44-3; 44-4; 44-5; 44-6; 44-7; 44-10
19	DR45-1; 45-2; 45-3; 45-4; 45-5; 45-6; 45-8
20	DR46-1; 46-2; 46-3; 46-4; 46-5 (A,B,C,D,E)
21	DR54-1; 54-2; 54-3; 54-4
22	DR55-1B; 55-2B; 55-3; 55-4A; 55-5

Appendix 8. ROCK PROCESSING

Basics:

1) Don't hesitate to ask if you're unsure about something.
2) Please don't leave something half-way done, regardless of whether you're on watch, unless you specifically pass the task on to someone else. (There is a tendency to do this when we get tired, but we can lose track of samples this way.) Leave a note if no one is there to relieve you.
3) Never guess about which sample is which - if you're not sure, say so on the label. Follow procedures to be sure!
4) Each processing station has a log book. Be sure to sign the samples in when you bring them to a station, and sign them out when you leave. *Note anything strange that may have happened during the processing.

DREDGES

Initial processing:

Dredges come on board on the stbd side. We carry the rocks into the main lab on burlap bags and lay them out on the stbd side table, on top of clean burlap bags. (Extra burlap bags are in a large wooden box in the hold) There are gloves and bags to use for this. Be sure to wear appropriate clothing (gloves, no flipflops, non-skid shoes) and safety gear on deck. Glass cuts! If there is a conflict with space, the dredges will be left outside on the deck or, possibly, in the Alvin hangar.

The rocks will be sorted by types, generally into 1-4 types. Type distinctions are made on the basis of age, flow morphology and mineralogy. It is generally safer to make more rather than fewer types, as analysis of the glasses will ultimately reveal the real chemical types, and we do not want to miss any. One of the types should be "station glass," which is loose chunks and fragments of glass. Some of this may come from the burlap bags. Do not label extra small pieces of rock as station glass.

In the dredge notebook, note the total dredge weight (kg) and overall description, then describe each type. (See examples from earlier dredges) Once the dredge is sorted, it should be photographed, with suitable scale and documentation (type and dredge number written on yellow paper) on color print film. (Charlie's camera and Henri Bougault's flash.)

Select working samples from each type (approx. 2 - 3 each, and approx. 5 from the station glass). Each working sample is described in detail in the notebook, in terms of size and appearance. Each sample also needs to be described on an individual sample sheet that goes in the blue binder. If the dredge was large, it may be necessary to photograph the working samples for adequate documentation. The larger working samples should be painted and labeled with assigned sample numbers. After the working samples are fully described and catalogued, put them in plastic bags and carry them upstairs. The plastic bags should be labeled on the outside, and there should be a tag on the inside with sample designation as well. If the working samples need to have glass chipped off of them, they can be put in the wooden box on the forward wooden table. If they are small enough to be crushed and sieved immediately, they can be put in the container (bucket or box) labeled as such. These are our own working lab samples, upon which most of the analyses will be made.

Also select a fist-sized (or larger) sample of each type, from each dredge, for the French lab. Make and update the separate list of these samples (a packing invoice) . These also need an individual sample sheet for the blue binder. Label them, put them in plastic bags, and store them in the gray bus tub underneath the map table.

The remainder of the dredge rocks in the main lab should be packed into burlap bags. The outside of each burlap bag should be labeled with the cruise number, Leg #, bag #. Each bag should also have a tag attached listing the contents. If the bag is only one dredge and one type, then that should be written on the outside as well. *Do not overload the bags. They need to be carried down a flight of stairs to the hold and they should be able to be carried/lifted with one hand.

Remember to label in triplicate! Labels should be outside the bag, inside the bag, and on a tag attached to the bag.

Glass Chipping:

The glass-chipping station is the wooden table upstairs on the stbd side. Always start with a clean, glass-free surface to prevent mixing samples. Put down clean paper (Old SeaBeam paper or white roll paper) Try using the wooden box on its side to keep the chips from flying all over. Use safety glasses! Use the small chisels, gently if possible so that the glass does not fly around the room. Pick up ONLY glass chips which are on the clean surface, NEVER pick up glass chips from the floor, the ceiling, or anywhere else. Chip off <u>all</u> of the glass possible, or glass will fall off during rock sawing or storage and be lost forever.

Write a brief description of the glass on the sampling sheet (from the blue binder) in terms of quality and quantity. Put the glass into a bag for further processing and put it in the "To be crushed and sieved" container. The rest of the rock goes into its original sample bag, then put in the wooden box labeled "To be sawed".

At the rock saw, cut at least one sample of each type, preferably more. Cut thin section chips for each type, at least one. Label the rock fragments and thin section chips with white paint and a Sharpie pen.

Thin section chips go into a separate bag, one per dredge. Cut samples are put back in their bag, and taken to another wooden table for further description. Describe the cut surfaces on the sampling sheets (the blue binder sheets again!). The hand lens and binocular microscope may be used for this.

Finally, the rocks go into their own original sample bags, then into a burlap or canvas sack labeled "lab samples." Ordinarily there should be one lab sample burlap bag per dredge.

Glass Processing:

After the glass is chipped off of the working samples, "some" should be crushed to the proper size fraction for picking. Use the percussion mortar and the sieves-- see instructions in a later section. "Some" could be as much as 20gm where the glass is abundant, or as little as a gram or two in other cases. For very small samples, we need to be very careful to not waste any material. *In general, a few large glass chips should be preserved, as they are needed for certain types of analysis (e.g., noble gases).

Save the fine fraction in a small Whirlpak or vial, and uncrushed sample in the original container. The working-size chips need to be cleaned in the ultrasonic baths in the wet lab. Use glass beakers and MQ water. (You can also try using alcohol, it is effective on some types of alteration.) Run the ultrasonic for about 5 minutes, decant the water, and repeat until the water is coming out clear or until it is apparent that you are just eroding the palagonite coating on the chips (that can take forever). The point of this step is to remove the loose dust and palagonite from the glass surfaces. Dry them in

the beakers or tin plates under the heat lamp. BE SURE that the beaker/tin plate is secured to the table (masking tape on a sheet of paper works fine) and check to make sure the table is not getting too hot. Be aware of how long the heat lamp has been on, and never leave it on overnight or unattended. Make sure that everything is clearly labeled! Assume that the labelling and organization has to be clear to someone else. Also, update the Rock Processing Log to show that the sample has been cleaned.

Put the dry, cleaned chips in a clean Whirlpak or vial. Designated people will select a few good, fresh chips for probe mounts using the binocular microscope. Put them into a separate small vial and then into a box labeled "probe chips." The rest of the clean chips go into a box labeled "clean glass to be picked" or if the sample has also been picked for plasma, then in the box labeled"picked for plasma and probe".

When picking glass for the probe mounts or plasma, look for fresh, clean glass with no alteration nor phenocrysts. Check all surfaces by rotating chips with tweezers. When picking glass for plasma, the criteria may be relaxed a bit because we do not want to deplete the samples of the freshest glass, which is more critical for other types of analyses (isotopes, alkalis, etc.). Glass grains with microlites, dull surfaces and palagonite specks may be acceptable for shipboard plasma analysis. Pick at least 30 grains (~50 mg) for plasma analysis. We did not adopt this relaxed criteria until plasma batch 16, however, so most shipboard data are for pristine glass grains. During the second leg, we kept a "picking log" to record our observations while picking the glass chips. Because these observations are made with a binocular microscope on cleaned grains of uniform size, this log provides the most accurate record of the state of alteration and phenocryst content of the glass samples.

ROCK CORES of all types

The core tips will be carried into the rock core alcove, between the main lab and the DCP. Set each one onto a sheet of paper LABELED WITH THE ROCK CORE #. Take a picture of the rock core (same as the dredges) and then describe it in the Rock Core Log. Note which core head was used, how many collar cores (from the Whumpfer) contained glass, and estimate an amount/weight.

There are basically three scenarios for rock core results:

1. There is a significant amount of glass on the core heads and sediment in the holes
2. There is only sediment in the core holes
3. There is no glass on the core heads, but some in the sediment.

Glass:

Case 1. For each core tip, use tweezers to pick out glass bits.The tweezers should be cleaned with alcohol and Kimwipes, or for hard-to-remove wax the Go-Jo by the sink in the Main Lab works well. Hot water works very well too. Be sure to get all the glass and don't worry too much if there is wax attached. Put chips and wax into a glass beaker. LABEL THE BEAKER.

The beaker goes into the wooden frame over a hot plate. Fill the beaker partway with tap water and cover the beaker. The chips pop and can pop out of the beaker, like popcorn. Set the hot plate at a low temperature; this will melt the wax, which will rise to the top of the water. It is not necessary to boil the water-- the wax melting point is pretty low. But boiling helps to agitate the mixture so that the wax releases the smallest chips and sediment. If wax balls remain on the bottom of the beaker adhered to glass grains, sonicate the beaker while still hot. It is best to let the wax cool before separation, as the cooled wax forms a solid lid that is easy to remove. If the wax is

poured off while still molten, wax inevitably remains in the bottom of the beaker and all over the sides. Remove the wax and put it in the used container. Then decant the water and repeat if necessary. When all wax is removed from the chips, rinse them in MQ water and then pour into an aluminum pan (LABEL IT!) Take the aluminum pan up to the hydro lab and dry under the heat lamp.

After the glass is picked out of the core tip, put the core tip into the box labeled "used." The core tips as well as the wax are recycled. To recycle the wax, melt the used wax in a pot. Let it convect a bit. Take it off the hot plate and let it sit to allow particles to settle to the bottom. Pour the molten wax into a clean container. Avoid pouring the mud-rich bottom layer! Wax recycling is about 90% efficient, although the wax becomes darker with each cycle, probably from fine sediment and grease. Recycling also tends to make the wax less sticky. We successfully used wax that had been recycled three times.

Sediment:
Cases 1&2 If we get significant amounts of sediment in the core holes/behind the wax, save it. Sticking a nail in the holes usually pushes out a "tootsie-roll"-like tube.

If there is glass in the sediment, we cannot assume that it is the same as the other glass in the rock core, so we treat it s a separate sample. First, take one portion of the sediment and save it as is, so we have a representative aliquot of the sediment as it was recovered. This should ideally be a couple of gm. Take the rest of the sediment, and "pan" it as you would for gold. The sediment is fine and light, and can be removed as a slurry (using Milli-Q), leaving forams, shells and glass in the bottom. This fine sediment fraction allowed to settle, and the water is pipetted off. It is then dried under the heat lamp and put in a whirl pak bag. Estimate the amount of coarse and fine sediment fractions and write it down in the log. If the glass chips are clearly visible and may be easily picked, put the coarse fraction in the can for picking. If the glass chips are very small or if there is abundant material, then the carbonate may be dissolved with acid. Using dilute nitric (0.5 - 1.0 N), dissolve as much of the carbonate material as possible. Agitate it until no it fizzes no more. Depending on the grain size and quantity, it may take several shots of acid to completely dissolve carbonate. Don't leave sample in acid too long, though, as that can leach the glass. Some of the large forams and shells may remain. When finished, decant the acid and rinse with abundant Milli-Q. Dry and store glass-rich residue. These procedures should be carefully documented.

Case 3 If there is no glass except for in the sediment, then follow the same procedures as above for separating the glass. Sometimes there is only a little sediment, and the total glass sample will be a few glass chips. In this case, save a minute amount of sediment as representative, picking out glass chips with tweezers where you can, and then process the rest of the sample.

In many cases, this treatment will result in four different samples per rock core: 1) glass or rock cleaned from the wax, 2) a sediment aliquot, 3) a coarse sediment fraction which may contain glass chips, 4) a fine sediment fraction.

The clean rock cores and sediments are put into the box labeled "rock core samples" and should be
taken up to the wet lab periodically to empty into the appropriate containers up there on the deep freezer. If the samples are clean enough and small enough, they can be picked for plasma and probe right from the bag/vial. If the samples are too dirty or too big, they should follow the same procedure of crushing and sieving as the other samples. During the second leg, we always crushed, sieved and cleaned (sonicating in

Milli-Q) the rock core samples before picking and storing. This was not routinely done during the first leg.

Rock cores and freefall cores are often not large enough to have plasma run on them. In these cases, just pick them for probe and make a note in the Rock Processing Log notebook. In general, if more than a 2-5 grams of material was recovered, the rock core samples were analyzed onboard by plasma.

PERCUSSION MORTAR:

This is a stainless steel mortar and pestle with a sleeve. It can rust; if it does, use 400 and 600 grit sand paper (wet) to remove the rust.

Before you use the percussion mortar, clean it with tap water and paper towels, then with alcohol and kimwipes (during the second leg, we used Milli-Q also, or sometimes just alcohol). Don't neglect the alcohol step-- besides cleaning, the alcohol helps prevent rust. Also make sure to clean the innermost edge of the well, where the ring fits in to place. Dust can get stuck there.

There are six sieves, two official-looking brass ones, two homemade fiberglass ones (750 and 1030 micron), and two stainless steel kitchen sieves. Use the 750 micron fiberglass sieve, and the smaller kitchen sieve. These should be cleaned the same way as the percussion mortar.

Set a piece of paper on the table and stack two sieves on top of it. Use the 750 fiberglass on the bottom and small kitchen sieve on the top. If you want larger chips, use the 1030 fiberglass on the bottom and the large stainless steel kitchen sieve on top. Most glass has lots of plagioclase and other phenocrysts so the smaller chips are often better to ensure a pheno-free chip. During the second leg, we only used the 750 micron sieve. For the next cruise, a back-up 750 sieve might be necessary, as repeated alcohol cleaning has deteriorated the epoxy seal. A 500 or 250 micron sieve may also be useful for really altered or phyric samples.

Some of the sample may already be the correct size chips, so before you crush anything, send the chips through the sieves. Whatever passes through both sieves to the paper is too small to use. Whatever chips are caught by the bottom sieve are the desired size. Whatever does not pass through the top sieve is too large, and needs to be crushed.

To crush: pull the pestle out of the mortar and put glass chips in the well. The maximum amount should be a little more than a single layer. Slide the pestle into position. If there are only a few chips, tap the pestel by hand. If there is a full layer, you will probably have to tap lightly with a hammer. Often the first tap just settles the chips into position, without breaking any. So try one light tap and one a little harder. If you hit too hard you will pulverize the glass, which is a felony. If the glass becomes dust, it is of limited use to anyone, and the sample is wasted. This is easy to do, so please be careful! Puffs of dust rising from the well are a clue that you should stop.

Do not crush the glass chips smaller than is absolutely necessary. Go lightly and do many steps;
Let PATIENCE guide you. This way, we end up with as much useable glass as possible.

When finished, lay out another piece of paper and dump the contents of the bottom sieve onto it. These chips go into a labeled beaker for an ultrasonic bath cleaning. The dust and tiny chips that passed through the bottom sieve are saved in a Whirlpak as the

"fines." The chunks that do not pass through the kitchen sieve or were not processed are saved as the "coarse fraction."

MAKING PROBE MOUNTS:

The plexiglass discs that we use as probe mounts have 16 holes in them. Each hole will have a glass chip, held in place by epoxy. Here's how we do it:

Take an index card, cut a piece of wide masking tape the same length as the index card. Fix the masking tape (face up) onto the index card using scotch tape. Although double-stick tape may simplify the procedure, it deforms when heating, which prevents the epoxy from curing properly. The discs are secured onto the index card with the face-up masking tape. Make sure that all 16 holes of each disc have sticky tape under them, this is how we hold the glass chips in place for the epoxy.

At the binocular microscope, choose one fresh, glassy chip for each sample, preferably chips without many crystals in them. Find a flat surface on the chip, and use tweezers to set the chip into one of the holes, flat size down onto the sticky tape.

On the map of the disc, note which sample you put into which hole. There should be 14 samples and two glass chips of the JDF-D2 glass standard. The JDF chips should always go in the same positions of the disc (see map). Also on the map, note anything unusual or noteworthy about the glass chips, e.g. "glass is altered, no fresh glass available" or "many tiny plag crystals."

By the time all the holes are filled, turn on the hot plate in the wet lab. You want the temp to stabilize at 135°C, use the surface thermometer to check this. It should be covered with a piece of aluminum foil to protect the surface from epoxy.

Mixing epoxy: We are using Petropoxy 154, which will set in a matter of tens of minutes on a hot plate but will not set for days at room temperature. Very convenient. There is a full instruction booklet from the company, kept on the shelf in the wet lab. Most of it refers to making thin sections, but it does give more info about the epoxy. The curing time for probe mounts is longer than for thin-sections.

BE AWARE THAT THE CURING AGENT ABSORBS WATER. ALWAYS KEEP IT IN AN AIRTIGHT BAG. OPEN AS INFREQUENTLY AS POSSIBLE.

Get one of the small plastic beakers. Fill to 5ml level with resin from the small squirt bottle. Add curing agent to the resin in a ratio of 1:10, for example, to 5ml of resin add 0.5ml of curing agent. Be sure to use the cc scale on the syringe, not the M scale. Wipe off the syringe, put the cap on securely.

Use a plastic stirring rod to mix the resin and curing agent. Mix THROUGHLY for at least three minutes, scraping the sides and bottom of the beaker frequently.

Let the resin sit for a few minutes (maybe longer), to allow bubbles to escape. Use the stirring rod to slowly drip small amounts of epoxy into each hole. Fill them a little bit at a time so that the epoxy flows in around each chip rather than trapping air bubbles around them. Then, put the probe disc (still attached to the index card) onto the hot plate so that it heats up. The hot plate should be at 135°C (or between 130° and 140°).

The epoxy will gel within 30 minutes, and will be fully cured after about 45 minutes on the hot plate. When fully cured, the epoxy becomes darker, a brownish yellow.

** Do not touch the curing disks as this will disturb the hardening reaction and will result in runny epoxy.

Then peel the disk off of the sticky tape and check to make sure that all the chips are secure in the epoxy. If so, use the steel scribe to etch the disc number onto the back side of the chip. Also write the label on the disc with a sharpie pen. You should now have a disc with 16 glass chips on the front side and a label scratched into the back side, and the disc number written in pen. You should also have a map of the back side of the disk that shows which sample chips are in which holes.

The extra epoxy can be stored in the beaker, covered with parafilm. Write a date on the beaker so that we know when that batch was mixed. Clean the stirring rod with alcohol.

Appendix 9. STEPS TO A PERFECTLY EXECUTED ROCK CORE (Recovery not guaranteed)

1) Have a clear site selected. On the MAR, beware basins, as they may be full of sediment.

2) Make sure rock core is ready. Screws tight? Safety lines attached? All core heads clean?

3) Verify that written position on planning sheet actually corresponds with the desired feature. Examine target and decide what size area is acceptable in case there are navigation or ship handling problems. If it is particularly tight, notify the bridge so they are aware of it. If there is a question and there may be last minute changes, let the bridge know in advance.

4) About 15 minutes before deployment, check with the bridge, so they know you are ready and who is running the station in the lab. Winch on? Engine room and winch operator notified? If the weather is bad, are Wayne or Richard alerted?

5) Is the science party alerted? Watchstander ready? Deployment team ready?

6) As the site is approached, verify position using GPS and beam point profiles. Understand where we are.

7) Turn radio to station 72. Notify bridge and deck that position is OK and science is ready to deploy.

8) Deploy rock core; zero meters; write position in three places, rock core handwritten log, Mac Rock Core log, and FAZAR log.

9) Give depth of site to winch and bridge.

10) Pay attention on the way down. Are we staying on the desired target? Is the winch going at 150m/min.? Is someone watching for the HIT?

11) About 150 meters before the hit, do a radio check with the winch operator.

12) Call out the HIT on radio. (Note that the hit can occur with 100m more wire out than the depth, particularly if the ship is moving.) Record HIT position in all three logs.

13) The winch operator will start up slowly, to make sure the core is not stuck (it has been sometimes). Once the wire out is ten or twenty meters less than minimum depth, let him know it is OK to go to full speed.

14) Be ready to recover rock core. Remove all heads, check that any part of rock core with glass on it is removed and replaced with clean materials.

15) Take core heads into rock core lab, label the core immediately, take photos, and describe the core, including estimate of the amount of material.

Appendix 10. HOW TO RUN THE SHIPBOARD DCP

1. Before you begin: Be sure drain bottle is empty. Turn on argon. If using high pressure tanks stay aware of the argon pressure remaining in the tank. Turn on exhaust fan.

2. Starting up: Jet assembly is set up the same way as on the multi-channel DCP at Lamont. The jet power supply has set screws instead of knobs for setting anode and cathode pressure. Light the plasma just as you would on the multi-channel DCP. Warm up the plasma for 15-30 mins. before proceeding.

3. To prepare for peaking: Turn computer power on and be sure PMT power has been on several minutes before beginning run. Because this is a single element machine we must peak on each element as we are going to run it. Place the unit in active diagnotic mode: turn diagnostic (DIAG) switch up, REPEAT switch to 0, MODE switch to 1, then flip AVG ONLY switch up then back down to zero amplifiers, press RESET. In this mode the TIME switch is actually the gain and you will want to have it at about 20, though it can vary from about 5 to 55.

4. Peaking: Run elements in the order given on the plasma run sheet. While some peaking solution is running through the plasma use the LED display to adjust the scroll both vertically and horizontally about the wavelength of interest until the unit achieves the maximum number of counts possible for the element you want to analyse. Fine tune the slit position in the horizontal and vertical direction to maximize counts as well. Place milli-Q in the sipper and be sure the counts go to background, otherwise you are on some peak other than the element you are looking for. If you have trouble seeing the peak you may increase the gain, if the peak goes offscale you may lower the gain. You may also adjust the PMT voltage to increase/decrease counts. For best results gain should be adjusted for a signal strength of no less than 5000-6000.

   We have had problems with noisy data at sea. During FAZAR, what seemed to help at the end was to have the nebulizer pressure increased to almost 30, and to search for a plasma position where there was less noise. This often was more on the side of the emission halo than dead in the center. Noise can be evaluated by looking at the raw counts in diagnostic mode. The range of individual readings should be on the order of 2-3% for good data to be obtained. Sometimes it was also better to run six five second readings rather than 3 seven second readings, as the longer total measurement time seemed to average out some of the intermediate time scale noise.

5. Enter the standard values: Place the instrument in Integrate mode: set MODE switch to INT, set TIME switch to 07, set REPEAT switch to 3, flip AVG ONLY switch up then back down, press RESET. Using the numeric keyboard, specify the concentration of the high standard (enter 1000 and press ENT HI) and the concentration of the low standard (enter 0 and press ENT LO). Pressing DIS HI and DIS LO will display the high and low standard values entered.

6. Setting the calibration curve: Aspirate the high standard solution into the plasma, press the A/R (autorange) button to automatically set system gain near mid-range. The A/R light will be on during this cycle. When completed the HI STD light will come on which will measure intensity of the high solution and set the value it calculates equal to 1000. When the HI STD light goes off press "data". Look at the printout to determine the gain (the gain will be the second two digits of the first four digit number usually 40XX). The best value for the gain is around 15 although as low as 05 is okay. The STAT light will come on if the gain is lower than 11. FFFF means the results are off

scale. If your solution is too concentrated you can fake out the machine by autoranging with the slit one width larger than the one you will be using for analysis. The high standard will go off-scale but you then rerun it with the slit on the width you will be using. This causes the machine to autorange with more signal than necessary so there is more range available for setting the high standard. High standard counts should be around 5000 so that a solution with as much as 2x the amount of the element can be analyzed (the display counts up to 9999) although it is unlikely that this would actually be possible with decent standard deviations. When you are pleased with the high standard value aspirate the low standard solution into the plasma and press LO STD. The measured intensity of this solution will be set to 0. Press data.

7. Preparing to run the samples: Every batch of samples must have a batch no. Elements must be analyzed in the order specified on the run sheet which will be the same for each batch. Before you begin write down the sample order, you will not have time once you begin the run. Determine your procedure using the wooden blocks and stick to it so you do not lose track of sample order. Drift corrections are done on the highs and timing is assumed to be constant between samples. It is crucial that you behave as an autosampler. Now is the time to chase everyone out of the work area.

8. Running the samples: Run samples in the order you've specified on the run sheet. Aspirate sample into the plasma, when you hear it enter the plasma wait ten seconds then press sample button. After the first analysis is completed (the first set of counts will appear on the display) you will remove the sipper from the sample being analyzed, wipe it off, and place it in the next sample bottle as quickly as possible. To expedite the process the next bottle should be uncapped and placed on the block ready to go. The first solution will remain in the tubing for the next two analyses then the data from the first sample will print out. Soon after the solution from the second sample will enter the plasma, you will count to ten and press sample. You will repeat this process until the entire batch is run through for the element in question, with each sample being analyzed twice. Note that no more than three unknowns should be analyzed between analyses of the hi. Check each analysis as you go, keeping track of the drift and of individual analyses that may be noisy. Noisy data can be re-checked at the end of the normal run.

9. Continuing: To begin the next element return to step 3 and follow the procedure exactly.

10. Shutting down: Turn off jet power supply and argon. Run milli-Q through the pump for a few minutes then cleanse the tubing by running air. Release tubing from peristaltic pump. Turn off argon supply, exhaust fan and cooling pump. Empty drain bottle.

11. Data quality: We will accept standard deviations as high as 3% for some elements but prefer to have less and expect much less for many elements. If standard deviations are consistently high, play around with the slit position on the plasma. For example, Na is happiest when the slit is well above the emission zone and Ti is happiest buried deep in the plasma. Often this will make the crucial difference between noisy and quiet data. If this doesn't work, shut down, rebuild the plasma, and start again. Data reduction takes too much time to waste time with terminally noisy data. Consistently noisy data can be caused by problems with the cooling system. If analyses are generally quiet but there are one or more aberrant points, run through the entire batch as specified on the run sheet then rerun the bad samples with no more than three unknowns between hi solutions. If one or more unknowns went offscale during the analyses rerun at a slit size half that of the one used for the rest of the analyses. Run the hi at regular slit size,

followed by half size, run the unknowns, then repeat the hi, end with a blank also at half slit size.

12. Data reduction: Enter average values for each sample into an Excel worksheet. If any of the analyses have bad standard deviations consider eliminating one of the three average counts listed. Do not do this unless it is clearly an aberrant point. If any of the unknowns were rerun at the end of the sample run, calculate the value for that sample that belongs in the spreadsheet by normalizing to the nearest two highs. If any of the unknowns were run at reduced slit size, normalize as above but be sure to subtract the blank analyzed at half slit size, as well. For each element, plot hi versus cup # to check for drift. Make a note of any potential problems in the drift. When the spreadsheet is completed copy the numbers plus a final column of zeros with a -1 in the final position and open Ship Reduce 1.01. Answer the questions. The data that output from the program will be saved in a file called "REDUCED DATA" which will appear in the same folder as Basic. Open this file into Excel, open the macro file. Put sample names into first column of "reduced data" and place two empty rows at the top. Run the macro "final dat". This will organize the data by sample name. Delete the hi and lo values listed. Run the macro "averages". This will average both analyses and calculate standard deviations. Look at the standard deviations to determine if there are problems.

13. Cleaning up the data: The most glaring error will be a typo into the spreadsheet, easy to solve. If a few analyses for a single element are noisy go back to the run sheets and see if there is an obvious way to make the first and second analyses closer in value. Often there will be an aberrant Hi which has made a drift correction that is inappropriate. Did you eliminate one of the three counts to make the data bad or could you eliminate one to improve it? Is the rerun used really a better value than the value obtained in the initial analysis? Was the hand calculation of the rerun vaue correct? Most data can be cleaned up in this way. Be alert to the fact that SiO2 makes up half the analysis, so a bad Si reading can propagate through all the other elements when the data are normalized to 99.5%. If one SiO2 reading is 3% high, then all other elements will be 3% low in response to normalization. If several analyses from the same element have high standard deviations consider running the element again. A different plasma can make a world of difference. When the data look acceptable on the averages sheet, run the "findat" macro to make a nice final table for that batch. Be sure to save all the raw data, the raw data input sheet, the average sheet and final data sheet in the run folder. It is best if this is done immediately upon completion of the data reduction.

Appendix 11. SLED LOG 1

Station ID format: A127-yyy-AAxx				yyy = station number				AA = operation type	
FAZAR All 127, Leg 1			ZAPS Sled Log						
	Station ID	Date	Time	Lat	Lat'	Lon	Long'	Depth	Comments
			GMT	°N		°W		meters	
Begin	A127-001-SL01	30 Aug 92	23:07	39	12.710	64	26.850		test lowering of sled, at 81 m stopped receiving data
End									sled brought back up on deck, swivel removed
Begin	A127-002-SL02	31 Aug 92	13:30	38	29.830	61	28.420		another test lowering of the sled, start collecting data
									at 20m down to 300m and stopped. Intend to tow at
									250m. Rosettes won't fire. stopped towing, start new
									file up to the surface.
Begin	A127-003-SL03	02 Sep 92	12:20	36	9.280	51	29.590		another vertical sled lowering. Lowering to 540m,
									things looking but Cara says "the nephel still looks
									like shit". Bottles fired at bottom.
Begin	A127-004-SL04								ENGINES OFF
		04 Sep 92	8:55						A-FRAME NOW READY. COCKING BOTTLES
			9:12						in the water; background water station
			9:38	33	46.055	41	40.539	3681	running down to 40 meters
			9:45						forgot to set RS232 port on.
			9:49						We're not getting any CTD data on SLED program.
									restarted Seasave and proceeding down from 10m
			9:50						depth. CTD data overflow error & software hassles
			9:57		46.068		40.418		starting down again from 10M
			10:18		45.864		39.909		3150 decibars; 3105M wire out
			11:11		45.474		39.643	3643	
			11:19	33	45.408	41	39.667	3640	stop 3552 wire out
									~90M off bottom; altimeter reading 2.0 volts
			11:30						come up 20M; altimeter eq. off by factor of 2
			11:33		45.353		39.660	3644	wire out 3512M; try to trip all bottles; no trips
			11:52		45.255		39.695	3649	coming up; try to trip bottles; grounding noise
			12:49		45.192		39.978	3652	sled at surface
end	A127-004-SL04	04 Sep 92	12:54		45.164		39.964	3655	sled on deck

									First major segment of Hayes fracture zone.
begin	A127-015-SL05	06 Sep 92	20:00	33	45.984	37	45.356	3505	Sled in water. The weather is exceptional; very calm,
									but unfortunately no spectacular sunset expected.
			20:06	33	45.949	37	45.355	3499	Still going down. And she is showing up on SHARK.
			20:22	33	46.007	37	45.307	3517	Wire out 1000 meters. All systems A-OK.
			20:53	33	45.918	37	45.256	3551	Deck unit froze up at 2100 meters. The computer is
									getting no data. Wire out 2934 meters and winch is
									now stopped. Cara is setting up second file.
			21:19	33	45.892	37	45.165	3516	Deck unit is not recieving data. Coming up.
end	A127-015-SL05	06 Sep 92	22:04	33	45.985	37	45.254	3544	Sled hits deck.
begin	A127-015-SL06	06 Sep 92	23:37	33	45.940	37	45.292	3515	Sled in water.All OK. Bottles tripped on deck / reset.
		07 Sep 92	0:05	33	45.923	37	45.292	3556	1,000 m. depth . 60 m/min winch out speed.
			0:21	33	45.971	37	45.291	3541	2,000 m. depth.
			0:36	33	45.998	37	45.292	3531	3,000 m. depth
			0:46	33	46.046	37	45.314	3520	3450 m. on wire out...3512 CTD pressure
									Altimeter seemed to start working about 150 MAB !
									Bottom of cast. Altimeter reads 86 meters.
									Tried Bottle Rosette enable. DID NOT WORK.
									IT ONLY WIGGED OUT THE ZAPS AND NEPHEL.
									NOT THE TRANS OR THE TEMPERATURE.......
			0:48						Coming up at 72 m/min.
									3300 CTD pressure. BAD Enable signal
									3100 CTD pressure. BAD Enable signal
									2900 CTD pressure. BAD Enable signal.
									2700 CTD pressure. BAD Enable signal
									2500 CTD pressure. BAD Enable signal
									2300 CTD pressure. BAD Enable signal.
									2100 CTD pressure. BAD Enable signal
									1900 CTD pressure. BAD Enable signal
									1700 CTD pressure. BAD Enable signal.
									1500 CTD pressure. BAD Enable signal
									Missed1300 CTD test point. Cara spaced out!
									1100 CTD pressure. BAD Enable signal.
									900 CTD pressure. BAD Enable signal.
									700 CTD pressure. BAD Enable signal.

	A127-015-SL06	07 Sep 92							500 CTD pressure. BAD Enable signal.
									300 CTD pressure. BAD Enable signal.
									100 CTD pressure. BAD Enable signal.
			1:35	33	45.908	37	45.103	3564	At surface...CTD Sled in air. Bad Enable Signal.
			1:37						ROSETTE ENABLED NOW WHILE SLED WAS IN AIR
			1:45						BEING LIFTED IN THE A-FRAME AND TAG LINED
end	A127-015-SL06	07 Sep 92							Sled secure on Deck III
begin	A127-049-SL07	10 Sep 92	15:34	35	17.001	34	52.733	2619	Sled in water, error message on deck unit
			15:35		17.012	34	52.743	2620	Sled coming back on deck
			15:38						Sea cable wasn't plugged into our deck unit...
			15:41						succesfully fired bottle position #1 (null) at 12m
			15:42		16.952		52.750	2586	going down....Altimeter = 290m.
									transmissometer died ~200, at 150m offscale (<70)
									transmissometer came back on scale at 430m
			15:53		16.871		52.739	2622	fired bottle position #2 (null) at 500m, nephel.
									wigged out, and unable to enable on deck unit
			15:57						pressure = 750m, altimeter = 215
									pressure = 1000m, altimeter = 244
									pressure = 1500m, altimeter = 220-270
									pressure = 2000m, altimeter = 240
			16:21		17.083		52.612	2602	a plume in the ZAPS?!.....
			16:26		17.064		52.670	2630	altimeter started decreasing at 2440m
									altimeter reads 60-75m, consistently decreasing
								2636	altimeter at 30m
			16:29		17.062		52.725	2616	pressure 2613, altimeter 23, wire out 2544
			16:30		17.066		52.747	2666	altimeter at 11m, pressure 2625, bringing it up
			16:33		17.035		52.804	2672	going up....
									2535 69 (pressure altimeter)
									2520 90 " "
									2500 100
									2480 125
									2450 150
									2400 195
									2375 215
									2350 237
									2325 234 and pegging out at 234....

	A127-049-SL07	10 Sep 92							2300 210-240
									2200 248, altimeter locked there for 100m
									plume at 2400-2800 meters...
									second mid-depth 'plume' 1300-1600m (?)
			17:11		16.926		52.674	2600	at surface, CTD deck unit off
end	A127-049-SL07	10 Sep 92	17:13	35	16.919	34	52.689	2615	Rosebud, the wonder sled, on deck
begin	A127-052-SL08	10 Sep 92	20:46	35	23.675	34	50.472	2434	in water - sight of Seabeam survey #2.
			20:50	35	23.700	34	50.452	2434	going down.
									found large cuts in rosette cable, replaced cable
									tried to enable at 400m, 470m, enabled at 470m only
									got data glitchs at both depths
			21:34	35	23.590	34	50.482	2454	bottom, wire out 2373
									tried to fire at 1550, couldn't enable, nep. glitched
			22:09	35	23.646	34	50.484	2435	at surface
end	A127-052-SL08	10 Sep 92	22:11	35	23.649	34	50.484	2433	sled on deck
Begin	A127-60-SL09	11 Sep 92	16:49	36	2.550	34	8.071	2626	in water
			16:53	36	2.577	34	8.070	2649	starting down
			17:02	36	2.570	34	7.907	2636	Transmissometer detected waste tank emptying
									(FTU) Freefall Turd Units
			17:40	36	2.523	34	8.127	2631	Altimeter alarm went off at 50m!!!
			17:41						Firing bottle at 2590; got data glitch in nephelometer
									and ZAPS; did not enable
			17:42	36	2.539	34	8.169	2632	Bringing up to 1950m; heading east to a ridge
			17:57	36	2.631	34	7.982	2626	Starting a horizontal sled tow to the ridge
			18:37	36	2.570	34	7.223	2356	still towing to ridge crest.
			18:41	36	2.569	34	7.144	2360	Stopping tow, going down, on crest nose.
			18:57	36	2.574	34	7.120	2368	Fire bottle; got data glitch in nep, zaps, didn't enable
			19:01	36	2.560	34	7.125	2364	wire out 2333, starting up
			19:38	36		34			Fire bottle at 220; got data glitch, didn't enable
			19:41	36	2.642	34	7.014	2335	at surface, CTD deck unit off
End	A127-60-SL09	11 Sep 92	19:43	36	2.659	34	7.014	2347	Sled on deck
Begin	A127-67-SL10	12 Sep 92	12:00	36	23.208	33	39.495	2597	in water
			12:03	36	23.192	33	39.444	2594	tried to fire bottle at surface, didn't enable

	A127-67-SL10	12 Sep 92	12:48	36	23.237	33	39.441	2590	At bottom. 2590 wire out
			13:01	36	23.207	33	39.361	2628	wire out 1610, tried to fire bottle, didn't enable.
			13:28	36	23.236	33	39.374	2619	deck unit off, sled at the surface
End	A127-67-SL10	12 Sep 92	13:32	36	23.236	33	39.375		on deck, secured
Begin	A127-76-SL11	13 Sep 92	6:00	36	44.987	33	17.701	2507	sled in water, deck unit on
			6:04	36	45.032	33	17.705		tried to fire a bottle at 12 m, no luck
			7:05	36	45.005	33	17.594	2567	alt = 71 mab, started reading ~150 m, starting upcast
									alt crapped out at ~220 mab
			7:58	36	45.179	33	17.605	2544	at the surface, deck unit off
End	A127-76-SL11	13 Sep 92	8:03	36	45.260	33	17.680	2593	on deck
Begin	A127-77-SL12	13 Sep 92	8:40						sled in water; soaking the reaction chamber
			9:11	36	49.874	33	16.168	2599	starting down
									neph and ZAPS echoing each other all the way down
			10:02	36	49.811	33	16.220	2640	wire out 2584M; bottom alarm
									check parameters on con file; nothing obvious
			10:06	36	49.814	33	16.208	2642	starting up
			10:42	36	49.849	33	16.208	2612	surface; deck unit off
End	A127-77-SL12	13 Sep 92	10:48	36	49.832	33	16.198	2633	on deck
Begin	A127-081-SL13	13 Sep 92	15:14	36	55.037	33	13.108	2954	in the water
									Rosette ENABLED at the surface; Twice!
End	A127-081-SL13	13 Sep 92	18:11	36	55.629	33	13.509	2830	sled on deck (other info lost)
Begin	A127-095-SL14	14 Sep 92	23:06	37	18.082	32	17.508	1766	in water (same station# as RC42)
									Rosette starting on #2; 1st bottle on #8
									rosette fired at 20m, data glitched, didn't enable
									transponder reading zero angle
			23:44	37	18.098	32	17.527	1767	wire out 1696M; stop
			23:46	37	18.110	32	17.511	1768	start to tow; heading 10°-30°
									want to tow yo-up to 1400M; down to 1800M
			23:52						going easterly toward 37°18.0'N; 32°17.0'W
		15 Sep 92	0:07	37	18.033	32	17.120	1638	winch stopped at 1300M; going down to 1550M
			0:15	37	17.981	32	16.955	1587	going NE toward 37°18.2'N 32°16.2'W
			0:23	37	18.034	32	16.726	1662	winch stopped 1600M; bottom alarm; towing up
			0:45	37	18.157	32	16.369	1730	winch stopped 1200M; wait to see if screen scrolls
									going to go S to 37°17.4'N 32°16.3'W

	A127-095-SL14	15 Sep 92	0:52	37	18.195	32	16.260	1724	towing down 20M/min
			1:10	37	18.078	32	16.150	1682	winch stopped 1655M; 1665 wire out; tow up
			1:24	37	17.826	32	16.207	1590	approaching top of seamount; Mn sig. ~200M above
			1:29	37	17.795	32	16.222	1576	stopping winch 1270M; towing down 20M/min
			1:37	37	17.664	32	16.214	1564	150M above seamnt; Mn decreasing to bkg at1440M
									Gary yelled Yippee
			1:43	37	17.598	32	16.220	1578	bottom alarm; wire out 1564; 1536M; towing up
									towing up to 1360M; heading to 37°17'N,32°17'W
			1:56	37	17.478	32	16.267	1611	stopping at 1280M; wire out 1297M
			1:59	37	17.452	32	16.300	1614	wire out20M/min to 1350M
			2:02	37	17.421	32	16.348	1636	changing hding to west; continuing down to1400m
			2:06	37	17.408	32	16.414	1648	stopping winch at 1400m
			2:11	37	17.399	32	16.478	1668	towing down 20m/min
			2:20	37	17.411	32	16.713	1720	Stopping at 1550; 1606 wire out
			2:23	37	17.403	32	16.780	1737	starting up to surface
			2:49	37	17.353	32	16.772	1700	at the surface
end	A127-095-SL14	15 Sep 92	2:51	37	17.361	32	16.772	1704	on deck
begin	A127-103-SL15	15 Sep 92	18:09	37	49.993	31	31.272	1015	in water
			18:15	37	49.989	31	31.276	1016	Transmissometer going off scale (<80%)
			18:23	37	49.993	31	31.273	1015	transmissometer back on scale at p=700
			18:29	37	50.001	31	31.279	1016	alarm sounded, beginning of tow-yo, wire out 947m
			18:46	37	49.426	31	31.273	998	kiting off bottom, lower at 10m/min till wire out 959
			18:49	37	49.800	31	31.296	996	coming up to 600m
			19:04	37	49.646	31	31.351	1025	went down at 700m, heard alarm at 50m, going up
			19:12	37	49.511	31	31.367	1029	stopped at wo = 625, p = 595, starting back up
			19:23	37	49.295	31	31.427	1020	wire out 1052, alarm sounded, coming up, P=982
			19:29	37	49.159	31	31.454	1023	winch stopped at 818m, P=700, going back down.
			19:36	37	48.988	31	31.534	1040	P=972, wire out ~1135m, alarm sounded, coming up
			19:42	37	48.859	31	31.591	1042	going down, wire out 860m, P=700
			19:49	37	48.720	31	31.662	1031	alarm sounded, wire out 1163, P =982, coming up
			19:54	37	48.601	31	31.699	1025	winched stopped 900m, P=723, going down
			20:01	37	48.503	31	31.865	1032	alarm sounded, wire out 1190m, P=998, coming up.
			20:27	37	48.260	31	31.475	959	Sled at surface, deck unit off
end	A127-103-SL15	15 Sep 92	20:30	37	48.243	31	31.537	959	on deck
begin	A127-116-SL16	16 Sep 92							Sled's GO rosette is reverse polarity, ground is NOT
									connected to the pressure case. Test thru 9000 m

	A127-116-SL16	16 Sep 92							of deep sea cable (on deck, no wata). Rosette fired
									early again (before the enable light went on.)
									9000 m cable replaced with 30 m deck cable and
									test performed again...still not working.
			19:21	38	17.708	30	41.137	339	in water , wrong location, depth should be 800m
			19:30	38	17.711	30	41.237	904	in right location, Seabeam was off
			19:46	38	17.744	30	41.155	875	in water again....
			20:08	38	17.719	30	41.106	879	p = 848, 847m wire out, coming up
									altimeter read 500 m all the way down (duct taped)
			20:31	38	17.791	30	41.174		surface (SeaBeam off)
end	A127-116-SL16	16 Sep 92	20:33	38	17.806	30	41.199		on deck
begin	A127-130-SL17	17 Sep 92	16:29	38	42.081	29	56.565	978	Into the water... Altimeter's not working/ correctly
			16:32						Altimeter is working/not correctly
			16:40	38	42.006	29	56.565	999	The nephelometer is happy and working
			17:00	38	42.008	29	56.531	1011	wire out 965, P = 972, stopped, alt not working.
			17:05	38	42.034	29	56.542	1000	coming up at 20 meters/min.
			17:11	38	42.025	29	56.496	1007	winch stopped, wire out 860, P = 867
			17:28	38	42.117	29	56.563	969	coming up 20 m/minute, All heading 310 at .7knt
			17:46	38	42.256	29	56.829	883	increasing towing speed to 1.5 kt
			17:54	38	42.340	29	56.991	817	p = 710, bringing wire in, 20 m/min, maintaining
									>100 mab
			17:58	38	42.402	29	57.105	770	wo = 739 m, p = 633, winch stopped, sled still kiting
			18:04	38	42.455	29	57.243	712	bringing wire in 20 m/min
			18:11	38	42.516	29	57.412	625	p = 485, wo = 600m, bringing wire in 10 m/min
			18:12	38	42.534	29	57.466	630	p = 475, wo = 586m, winch stopped
			18:24	38	42.643	29	57.743	560	p = 478, wo = 585, hauling in to w = 550
			18:25	38	42.655	29	57.769	544	P = 441, wo = 550, wire stopped
			18:27	38	42.676	29	57.818	530	increasing speed to 2 kt, p = 441, wo = 550
			18:28	38	42.691	29	57.853	517	bringing wire in 20m/min, p = 441
			18:31	38	42.717	29	57.940	486	wo = 498, p = 370, winch stopped
			18:37	38	42.807	29	58.177	419	p = 340, wire in at 40 m/min
			18:39	38	42.830	29	58.225	385	winch slowed to 20 m/min
			18:43	38	42.878	29	58.355	376	winch slowed to 10 m/min
			18:44	38	42.895	29	58.392	384	winch stopped, wo = 330m, p = 250
			18:48	38	42.982	29	58.556	308	hauling in 20 m/min, p = 215
			18:49	38	43.007	29	58.592	302	winch stopped, wo = 310, p = 208

	A127-130-SL17	17 Sep 92	18:59	38	43.153	29	58.931	280	winch coming up 20m/min, wo = 289, p = 217
			19:01	38	43.168	29	58.972	304	P = 209, wire out 270, winched stopped
			19:16	38	43.452	29	59.488	192	coming in at 50, P = 156, wo ~230
			19:18	38	43.494	29	59.552	168	P = 125, wo = 161, winch stopped
			19:24	38	43.589	29	59.751	210	c/c to 270°
			19:32	38	43.567	30	0.046	254	p = 133, wire down 20 m
			19:33	38	43.563	30	0.066	267	wo = 181, winch stopped
			19:35	38	43.561	30	0.153	271	p = 148, wire down another 50 m
			19:38	38	43.567	30	0.283	275	wo = 230 m, up at 50 m/min
			19:43	38	43.566	30	0.465	272	wo = 125, p = 112, down at 40 m/min
			19:45	38	43.565	30	0.575	263	wo = 170, p = 170, winch stopped
			19:47	38	43.577	30	0.705	264	p = 157, wo = 203, up at 50 m/min
			19:50	38	43.581	30	0.786	281	p = 78, wo = 100m, winch stopped
			19:53	38	43.580	30	0.915	302	p = 90
			20:02	38	43.566	30	1.332	348	New waypoint = 38 43.3 N, 29 0.6 W
			20:08	38	43.581	30	1.332	358	bringing sled up to 80 m
			20:22	38	43.382	30	0.803	266	p = 73, down at 40 m/min to p = 180
			20:30	38	43.284	30	0.643	218	p = 201, up 10 m
			20:31	38	43.286	30	0.639	217	p = 190, wo = 189, winch stopped
									restarting program for upcast
			20:38	38	43.325	30	0.516	265	down to p = 230
			20:39	38	43.325	30	0.516	266	down another 10 in pressure
			20:40	38	43.321	30	0.520	262	starting up at 20 m/min
			21:01	38		30			program terminated
			21:06	38	43.514	30	0.532	289	surface, Rosebud's getting a wash down
end	A127-130-SL17	17 Sep 92	21:10	38	43.562	30	0.520	263	on deck
begin	A127-133-SL18	17 Sep 92	23:52	38	47.491	30	5.014	1142	in the water, going down (altimeter stuck at 500m)
		18 Sep 92	0:20	38	47.513	30	5.009	1139	wo = 1040, p = 1051, stopping winch
			0:25	38	47.509	30	5.007	1138	starting tow-yo, approx due N, 0.5 kt
			0:48	38	47.760	30	5.030	1189	wo = 1040, p = 1030, haul in at 20m/min
			0:49	38	47.786	30	5.033	1205	upto 1 kt (requested 1.5 from bridge)
			0:54	38	47.913	30	5.044	1250	wo = 908, p = 850, stop winch, haul out at 20m/min
			0:58	38	48.044	30	5.054	1311	wo = 980, p = 876, increase to 40m/min
			1:02	38	48.160	30	5.067	1298	wo = 1175, p = 1011, upto 1.5 kt, slow to 1 kt
			1:06	38	48.260	30	5.089	1284	wo = 1300, p = 1105, stopping winch
			1:17	38	48.460	30	5.010	1265	wo = 1300, p = 1130, haul out at 20m/min

	A127-133-SL18	18 Sep 92	1:19	38	48.493	30	5.006	1275	wo = 1336, p = 1175, stop winch, sped upto 1.5 kt	
			1:25	38	48.637	30	4.995	1257	wo = 1336, p = 1176, sped upto 2 kt	
			1:36	38	48.972	30	5.143	1270	wo = 1336, p = 1050, decrease to 0.5 kt	
			1:39	38	49.018	30	5.146	1283	wo = 1336, p = 1070, sped upto 2 kt	
			1:48	38	49.269	30	5.163	1375	wo = 1336, p = 1030, haul out at 20m/min	What
			1:50	38	49.339	30	5.170	1399	wo = 1375, p = 1040, haul out at 40m/min	I
			1:52	38	49.400	30	5.178	1385	wo = 1452, p = 1100, stop winch	wouldn't
			2:04	38	49.774	30	5.186	1243	wo = 1452, p = 1012, haul out at 40m/min	do
			2:07	38	49.868	30	5.185	1257	wo = 1568, p = 1099, stop winch, 1.7 kt s.o.g.	for
			2:33	38	50.687	30	5.152	1281	wo = 1568, p = 1000, haul out at 40m/min	a
			2:38	38	50.823	30	5.151	1326	wo = 1713, p = 1100, stop winch	plume!...
			2:39	38	50.858	30	5.149	1327	error light on deck unit, p = 1101	
			2:43	38	50.989	30	5.127	1301	Seasave restarted with new file, p = 1098	
			3:06	38	51.729	30	5.252	1367	wo = 1713, p = 1060, haul out at 40m/min	
			3:08	38	51.770	30	5.262	1351	wo = 1764, p = 1100, stop winch	
			3:19	38	52.109	30	5.253	1379	wo = 1764, p = 1067, haul out at 40m/min	
			3:20	38	52.233	30	5.185	1399	wo = 1876, p = 1150, stop winch	
			3:46	38	52.957	30	4.704	1209	wo = 1876, p = 1190, haul in at 50m/min	
			3:53	38	53.131	30	4.535	1173	wo = 1567, p = 1000, stop winch	
			3:59	38	53.258	30	4.514	1151	p = 1061, at way point, ship stopped, haul in at 50m	
			4:09	38	53.252	30	4.403	1136	wo = 1100, p = 1019, stop winch	
									p = 1111, started upcast file, alt valid for ~30 sec	
				38	53.158	30	4.419	1131	wo = 1100, haul in at 40m/min	
									alt occassionally gives out valid numbers, but then	
									ZAPS and light trans. wig out	
			4:28	38	53.152	30	4.297	1171	wo = 700, p = 707	
			4:38	38	53.162	30	4.120	1200	wo = 300, p = 301	Can
			4:47	38	53.138	30	3.868	1254	at surface, deck unit off	we
end	A127-133-SL18	18 Sep 92	4:50	38	53.132	30	3.816	1268	on deck	sleep
										now?
Begin	A127-138-SL19	18 Sep 92							grounding cable from the seacble armor to the CTD	
									fish, deck unit into wall instead of SeaBeam power	

	A127-138-SL19	18 Sep 92							
		way point #	5	38	53.100	30	4.500		
			6	38	54.000	30	4.100		
			7	38	55.200	30	1.200		
			8	38	56.700	30	3.500		
			9	38	56.200	30	1.400		
			10	38	58.200	30	3.200		
			11	38	59.000	30	4.300		
			12	38	58.200	30	0.000		
			11:47	38	53.206	30	4.520	1151	in the water; program needs adjusting
			11:54	38	53.123	30	4.580	1177	starting down
			12:20	38	53.165	30	4.500	1146	stopped; wo = 1091; p = 1102
			12:25	38	53.176	30	4.500	1149	start toward 38°54.0N, 30°4.1W; 0.5knot
			12:29	38	53.206	30	4.504	1145	stop program to change scale on neph.; start again
			12:33	38	53.242	30	4.528	1155	speed up to 1.0 knot
			12:43	38	53.398	30	4.470	1164	c/s to 1.5 kt
			12:58	38	53.742	30	4.220	1259	p = 991, wire out 50 m to p = 1000
			13:02	38	53.901	30	4.130	1218	wo = 1194, p = 977, winch stopped
			13:05	38	53.979	30	4.109	1201	ship slowing toward waypoint 6
			13:10	38	54.041	30	4.068	1195	hauling in at 20 m/min
			13:13	38	54.068	30	4.052	1192	starting program over for vertical, bringing sled
									to the surface to remove altimeter
			13:15	38	54.095	30	4.021	1185	in at 35 m/min
									ZAPS noise decreases with incr. dist. above bottom
			13:47	38	53.944	30	4.089	1190	surface, deck unit off
			13:51	38	54.056	30	4.115	1208	on deck
			14:02	38	54.299	30	4.088	1235	back in the water after removing altimeter
			14:33	38	54.056	30	4.096	1196	stopping the winch, p = 1150, wo = 1139
			14:40	38	54.110	30	4.096	1204	starting program over, beginning tow-yo from
									way point 6, hd = 063, 1 kt
									now near the bottom, no gliches, all traces look
									cleaner!
			14:52	38	54.255	30	3.850	1269	c/s to 2 kt
			14:57	38	54.380	30	3.584	1350	p = 1000, wo = 1139, paying out at 30 m/min
			14:59	38	54.414	30	3.513	1383	paying out at 50 m/min
			15:04	38	54.503	30	3.343	1392	p = 1200, wo = 1464, winch stopped

	A127-138-SL19	18 Sep 92	15:09	38	54.568	30	3.176	1418	p=1138, wo=1464, out at 50 m/min to p=1200
			15:11	38	54.606	30	3.070	1375	p=1203, wo=1592, winch stopped
			15:17	38	54.688	30	2.840	1363	p=1113, paying out at 50 m/min
			15:19	38	54.716	30	2.719	1391	stopping winch at p=1200, wo=1722
			15:36	38	54.899	30	2.046	1247	lt=86.85, Z=2.817, n=0, p=1084
			15:48	38	55.091	30	1.567	1127	p=1050, hauling in 100 m of wire at 50 m/min
			15:49	38	55.119	30	1.486	1146	wo=1620, p=985, winch stopped
			15:54	38	55.177	30	1.318	1144	hauling in 100 m of wire (to 1520)
			15:57		55.220		1.216	1053	hauling in to 1420 m wire out
			16:04	38	55.139	30	1.213	1054	stopping at wo=1000m, p=856 and dropping as
									the sled swings in under the ship
			16:15	38	55.195	30	1.460	1162	wo=1000, coming up to p=500 at 50 m/min
			16:30	38	55.169	30	1.467	1168	wo=299, p=300, winch stopped
									Starting new file downcast
			16:32	38	55.174	30	1.450	1165	starting down at 50 m/min
			16:49	38	55.232	30	1.470	1163	winch stopped, P=1050, wo=1043
			16:55						increasing speed to a knot and a half, heading 352
			17:06	38	55.601	30	1.447	1107	going down 20 meters/min. , P=974,
			17:09	38	55.631	30	1.435	1102	stopped winch at P=1020, wo=1068
			17:24	38	55.876	30	1.536	1140	P=1007, requested 2 knot speed over ground.
			17:33	38	55.999	30	1.862	1256	P=880, winch going down 50 meters/min..
			17:43	38	56.183	30	2.304	1356	coming up at P=1162, wo=1475-think we hit
									bottom because screen going crazy.
			17:47	38	56.206	30	2.372	1356	winch stopped at wo=1045, P=1041, screen O.K.
			17:51	38	56.257	30	2.508	1347	going down till P=1100
			17:54	38	56.307	30	2.628	1409	winch stopped at P=1100, wo=1569.
			18:01	38	56.416	30	2.909	1407	P=1020, going down 50 meters/minute
			18:05	38	56.469	30	3.040	1394	winch stopped at P=1150, wo=1735.
			18:12	38	56.552	30	3.196	1379	ship slowing so winch coming in 25 meters/min,
									in order to keep P=~1200
			18:15	38	56.575	30	3.220	1352	vary winch between 20-30 meters/min, P=1204
			18:50	38	56.669	30	3.506	1287	wo=1016, p=1013, approaching way point #8
			18:52	38	56.674	30	3.490	1287	p=900, wo=889, winch stopped
			18:57						going down to p=1250, then off to waypoint 9
			19:03	38	56.697	30	3.541	1291	winched stopped wo=1245, P=1258, off to #9.
			19:23	38	56.640	30	3.179	1298	wo=1245, P=1218, beginning tow at 2 knots.
			19:37	38	56.667	30	2.657	1404	wo=1245, P=1050, going out 50 meters/min
			19:44	38	56.690	30	2.365	1392	winch stopped at wo=1587, P=1275

	A127-138-SL19	18 Sep 92	20:11	38	56.690	30	1.418	1191	wo = 1587, p = 1099, in at 60m/min, appr. #9	
			20:18	38	56.656	30	1.395	1190	wo = 1128, p = 910	
			20:19	38	56.654	30	1.390	1188	wo = 1098, p = 892, winch stopped	
			20:34	38	56.698	30	1.404	1191	wo = 1147, p = 1150, hauling in at 30m/min	
			20:44	38	56.693	30	1.407	1191	wo = 765, p = 768	
			20:54	38	56.691	30	1.410	1187	wo = 251, p = 252, stop winch, flipped optical disk	
			21:19	38	56.637	30	1.408	1188	starting down again with a new file on a new disk	
			21:37	38	56.638	30	1.389	1185	heading towards way point #10	
			21:40	38	56.637	30	1.407	1188	wo = 1139; p = 1150. winch stopped. ZAPS = 2.78	
			21:53	38	56.770	30	1.722	1381	wo = 1139; p = 1058; going down to p = 1150	
			21:57	38	56.841	30	1.790	1424	winch stopped wo = 1266; p = 1150	
			22:10	38	57.187	30	2.045	1407	down more	
			22:14	38	57.247	30	2.113	1407	winch stopped wo = 1376; p = 1161	
			22:24	38	57.472	30	2.390	1375	paying out 50M/min; p = 1059	
			22:27	38	57.540	30	2.463	1351	wo = 1500M; p = 1142	
			22:29	38	57.606	30	2.533	1360	stopped winch; wo = 1626; p = 1200	
			22:38	38	57.810	30	2.756	1462	paying out 40M/min, going down to p = 1250	
			22:41	38	57.859	30	2.804	1499	stopped winch, wo = 1749; p = 1250	
			22:43	38	57.916	30	2.883	1480	going down to p = 1300	
			22:45	38	57.957	30	2.928	1491	stopped p = 1268; wo = 1803	
			22:57	38	58.199	30	3.193	1345	local high; p = 1257; wo = 1808	
			22:58	38	58.224	30	3.219	1348	coming up; going to p = 1200	
			23:01	38	58.264	30	3.259	1342	stopped p = 1200; wo = 1712	
			23:05	38	58.355	30	3.376	1358	coming up to 900m	
			23:14	38	58.551	30	3.561	1519	wo = 1332; p = 900; going back down to p = 1300	
			23:28	38	58.825	30	4.023	1331	stopped p = 1250; wo = 1773	
			23:34	38	58.916	30	4.713	1375	wire coming in	
			23:38	38	58.982	30	4.272	1428	stopped p = 1190; wo = 1588	
			23:40	38	59.010	30	4.322	1409	wire coming in p = 1130	
									lost data due to computer crash; data not saved	
									at least 20min of the data lost was when sitting at	
									waypoint #10A waiting for the sled to swing under	
									the ship; then went over small low	
		19 Sep 92	0:25	38	59.727	30	3.708	1345	wo = 1514; p = 1200	
			0:32	38	59.819	30	3.650	1318	wire in ~30m/min; starting wo = 1513; p = 1200	
			0:35	38	59.841	30	3.626	1327	stopped wo = 1447; p = 1191	
			0:41	38	59.878	30	3.626	1312	wire coming in50M/min wo = 1375;	well
			0:51	38	59.792	30	3.667	1315	stopped wo = 914; p = 900m	we

	A127-138-SL19	19 Sep 92	0:53	38	59.771	30	3.694	1314	going down 50m/min to p = 1260m	know
			1:00	38	59.758	30	3.767	1307	stopped, wo = 1240; p = 1250	where
			1:03	38	59.799	30	3.737	1292	going down 20m/min to p = 1270	they
									stopped wo = 1259; p = 1270	ain't
			1:04	38	59.818	30	3.677	1294	coming up 20m to p = 1240; wo = 1238	
			1:13	38	59.813	30	3.603	1334	underway to waypt #12 p = 1241; 1.5-2knt	
			1:18	38	59.728	30	3.427	1431	going down 30m/min	
			1:19	38	59.701	30	3.361	1443	incr to 50m/min target p = 1250; current p = 1214	
			1:20	38	59.683	30	3.322	1451	stopped wo = 1361; p = 1250	
			1:31	38	59.548	30	2.992	1488	steady p = 1115	
			1:33	38	59.521	30	2.924	1469	payout 50m/min; target p = 1200	
			1:36	38	59.476	30	2.830	1452	stopped wo = 1511; p = 1196	
			1:41	38	59.398	30	2.659	1413	p = 1130	
			1:43	38	59.379	30	2.617	1394	going down to p = 1200, 40m/min	
			1:46	38	59.331	30	2.509	1430	wo = 1637, p = 1200, stop winch	where
			1:57	38	59.150	30	2.150	1512	haul up to p = 700, 50m/min	are
			2:10	38	58.936	30	1.720	1482	wo = 1083, p = 700, stop winch	the
			2:12	38	58.924	30	1.691	1483	pay out at 50m/min	plumes?!
			2:25	38	58.709	30	1.222	1434	wo = 1751, p = 1200, stop winch	
			2:33	38	58.599	30	0.998	1454	p = 1169, not really rising, 1.4 kt, speed upto 2 kt	
									next way pt: 39 2.7 N, 30 1.7 W	
			2:42	38	58.462	30	0.668	1319	p = 1109, pay out at 50m/min down to p = 1300	
			2:44	38	58.417	30	0.570	1322	p = 1210, wo = 1878, stop winch	
			2:53	38	58.290	30	0.261	1234	haul in at 50m/min, p = 1150	
			2:57	38	58.247	30	0.113	1235	p = 1000	
			3:00	38	58.199	30	0.016	1242	p = 900, 1 kt	Not
			3:04	38	58.168	30	0.016	1247	turning to starboard	here
			3:06	38	58.141	30	0.000	1250	wo = 1197, p = 845, stop winch	mate!!
			3:11	38	58.133	30	0.063	1248	p = 1000	
			3:15	38	58.155	30	0.080	1239	p = 1100	
			3:24	38	58.205	30	0.065	1237	haul in to 800m at 50m/min, p = 1190	
			3:28	38	58.225	30	0.047	1238	p = 1000	
			3:33	38	58.228	30	0.003	1245	p = 800, wo = 798, stop winch, now down to 50 mab	
			3:38	38	58.205	29	59.941	1259	p = 1000	
			3:42	38	58.189	29	59.899	1264	p = 1190, wo = 1186 (a ZAPS signal?!?!)	
			3:45	38	58.121	29	59.896	1267	p = 1200, wo = 1208, stop winch	
									c/c to 345° (no, we were hallucinating...)	
			3:52	38	58.213	29	59.922	1257	p = 1215, and we're off again....	

	A127-138-SL19	19 Sep 92	4:10	38	58.737	30	0.174	1331	p = 1000 and rising (no; Carol still believes)
			4:12	38	58.796	30	0.202	1332	p = 975, light trans. bliped down
			4:15	38	58.900	30	0.257	1332	payout 50m at 30m/min, p = 928
			4:21	38	58.900	30	0.332	1332	p = 1050, l.t. still bliping out...
			4:23	38	59.137	30	0.354	1345	p = 1100, wo = 1466, stop winch
			4:26	38	59.239	30	0.383	1382	upto 2 kt, p = 1074
			4:36	38	59.519	30	0.488	1347	goin down 50m/min to p = 1200, p = 1025
			4:40	38	59.618	30	0.515	1335	p = 1200, wo = 1650, stop winch
			4:53	39	0.008	30	0.655	1403	p = 1132, kiting up; l.t. stopped its noise
			5:09	39	0.464	30	0.848	1478	haulout at 50m/min, p = 1100
			5:13	39	0.608	30	0.917	1494	**p = 1300, wo = 1897, stp winch (Chris did it)**
			5:19	39	0.745	30	0.990	1518	p = 1277, haul in at 20m/min
			5:26	39	0.935	30	1.081	1512	p = 1166, l.t. going to hell in a handbasket
			5:31	39	1.111	30	1.169	1464	p = 1100, wo = 1680, stop winch
			5:34	39	1.187	30	1.204	1480	p = 1100, haul in 20m/min
			5:41	39	1.395	30	1.284	1465	p = 1000
									l.t. came back from hell w/o handbasket at p ˜986
			5:48	39	1.626	30	1.358	1418	p = 900, wo = 1409, stop winch
			6:00	39	2.051	30	1.507	1344	p = 845, pay out at 50m/min to p = 1100, wo = 1409
			6:07	39	2.320	30	1.596	1351	p = 1100, wo = 1777, stop winch
			6:08	39	2.349	30	1.607	1350	at way point in ˜15 min, haul in 50m/min
			6:15	39	2.566	30	1.664	1259	p = 845, l.t. glitching again (signal? yes or no?)
			6:21	39	2.641	30	1.683	1257	p = 800, wo = 1155, stop winch (the debate rages...)
			6:30	39	2.700	30	1.718	1256	p = 1000 (l.t. still wigged, Chris swears it's real)
			6:38	39	2.722	30	1.739	1260	p = 1100
			6:41	39	2.697	30	1.730	1259	p = 1130, l.t. clean now
			6:42	39	2.694	30	1.729	1262	p = 1135, going down at 20m/min, wo = 1150
			6:46	39	2.698	30	1.708	1256	p = 1240,wo = 1234, stop winch
			6:47	39	2.697	30	1.706	1256	up at 50m/min to 700m
			6:54	39	2.681	30	1.712	1256	p = 900
									new waypt: 39 6.3 N, 30 1.2 W
			6:57	39	2.673	30	1.701	1258	p = 792, wo = 785, down to p = 1200 at 50m/min
			7:05	39	2.694	30	1.685	1256	p = 1200, wo = 1189, stop winch
			7:25	39	3.265	30	1.611	1261	p = 976, cruisin' at 2 kt
			8:00	39	4.452	30	1.461	1371	cruisin along, p = 1067
			8:17	39	4.971	30	1.423	1408	coming up - all the way - about bloody time
			8:47	39	5.179	30	1.410	1397	on surface, deck unit off
End	A127-138-SL19	19 Sep 92	8:49	39	5.221	30	1.430	1387	on deck

Station ID format: A127-yyy-AAxx

FAZAR All 127, Leg 2 — SLED 2 LOG the fun continues....

	Station ID	Date	Time GMT	Lat °N	Lat '	Lon °W	Long '	Depth (m)	Comments
Begin	A127-142-SL20	27 Sep 92	9:29	40	28.166	29	33.065	2966	sled in the water
			9:40	40	28.190	29	33.046	2966	ZAPS voltage = 0, recovering sled
			9:44	40	28.191	29	33.064	2970	surface
			9:47	40	28.197	29	33.090	2969	on deck (flash tube burnt out)
									ZAPS cartridges off
			10:06	40	28.281	29	33.095	2969	in the water, on the way down
									waypoint 40° 28.9 N, 29° 32.7 W
			11:15	40	28.310	29	33.143	2969	winch stopped at p = 2920, wo = 2875
			11:21	40	28.363	29	33.121	2957	bringing wire in, 20 m/min, beginning tow
									heading off toward waypoint 40° 28.9 N, 29° 32.7 W
			11:22	40	28.387	29	33.080	2947	program wigged -- resetting and starting over
			11:29	40	28.527	29	32.989	2921	c/s to 30 m/min
			11:46	40	28.855	29	32.749	2826	wo = 2202, p = 2100, stopping winch
									wire out at 40 m/min
			11:54	40	28.977	29	32.662	2879	c/s to 60 m/min
			11:59	40	28.905	29	32.725	2850	winch stopped at p = 2770, wo = 2811, tow file stopped
			12:01	40	28.897	29	32.711	2831	beginning upcast, attempting to fire a bottle (#1)--
									enable light came on, but fire confirm light didn't
									tried this twice near the bottom (2750m & empty)
									empty position
			12:07	40	28.914	29	32.654	2853	bottle #2 at 2600 m
									empty position
			12:10	40	28.909	29	32.647	2843	bottle #3 at 2400 m
			12:10						empty position
			12:12	40	28.927	29	32.647	2860	bottle #4 at 2200 m
			12:13						2180 m blank position, still no comfirmation
			12:14	40	28.937	29	32.643	2858	bottle #5 at 2100 m
									firing blank, still no comfirmation
			12:16	40	28.938	29	32.669	2851	bottle #6 at 2000
			12:42	40	29.187	29	33.135	2978	last bottle position at 100 m wire out, p = 87

	A127-142-SL20	27 Sep 92	12:42						fire button pushed, no confirmation
			12:50	40	29.312	29	33.333	2966	surface
End	A127-142-SL20	27 Sep 92	12:55	40	29.499	29	33.472	3034	on deck
									all bottles closed, handle on bottle #5 broke
Begin	A127-148-SL21	27 Sep 92	22:53	40	17.586	29	34.131	2502	sled in water, ZAPS OK, on way down
									WP1 40°18.3'N 29°33.5'W
									WP2 40°19.6'N 29°33.2'W
			23:52	40	17.731	29	33.842	2486	50m off bottom: zippo; coming back up, no tow
		28 Sep 92	0:12	40	17.868	29	33.923	2479	Bott.1(1000m) Hit ZAPS on enable (hi) & fire (lo)
			0:14	40	17.869	29	33.900	2479	Pos.2 (876m) Hit ZAPS on enable (hi) and fire (lo)
									DISCONNECT ROSETTE-FIRING ON RECOVERY OF SLED
									ZAPS Volts tracked to 0V, 876m-400m.
			0:29	40	17.876	29	33.970	2490	sled at surface
end	A127-148-SL21	28 Sep 92	0:33	40	17.884	29	33.967	2514	on deck
									First 2 bottles tripped! Fire hit twice, Enable hit 3x
begin	A127-149-SL22	28 Sep 92	1:16	40	22.232	29	33.585	2770	Sled in water, ZAPS OK, going down
									WP1, 40°22.5'N 29°33.1'W
									WP2, 40°24.2'N 29°33.0'W
			2:15	40	22.342	29	33.903	2769	2700m, zippo again, starting up-cast.
			2:59	40	22.136	29	33.750		sled at surface.
end	A127-149-SL22	28 Sep 92	3:02	40	22.127	29	33.664		sled on deck.
begin	A127-193-SL23	01 Oct 92	20:52	37	17.624	32	16.112	1614	in water, rosette in pos 11, bottles in odd positions
									waypoint 1 = 37° 17.6'N 32° 13.8'W
									2 = 37° 16.8'N 32° 14.5'W
									3 = 37° 17.6'N 32° 16.0'W
			21:04	37	17.592	32	16.042	1594	tried to fire, got enable, but no confirm, no mark,
									and no data glitch
			21:36	37	17.613	32	15.871	1659	winch stopped, p=1600, wo=1582
									starting program in tow mode
			21:42	37	17.602	32	15.830	1666	wire in at 30 m/min
									wire out at 30m/min, p=1050
									ship had speeded up to >2 kts, keeping it to 1.5 kt
			22:17	37	17.500	32	14.634	1945	nada
			22:24	37	17.485	32	14.461	1988	wo=1956, p=1600, wire in at 30m/min

	A127-193-SL23	01 Oct 92	22:47	37	17.561	32	13.785	2139	wo = 1260, p = 949, wire out at 30m/min
			22:59	37	17.652	32	13.724	2136	wo = 1260, p = 1154, wire out at 60 m/min
			23:13	37	17.758	32	13.716	2142	slowing to 30 m/min
			23:17	37	17.731	32	13.712	2138	wo = 2100m, p = 2110, winch stopped
			23:17	37	17.733	32	13.708	2139	wire in at 30 m/min, started towing again
			23:23	37	17.708	32	13.805	2144	speeded up to 60 m/min
			23:41	37	17.381	32	14.015	2116	wo = 899, p = 869, winch stopped
			23:43	37	17.345	32	14.029	2094	wire out at 60m/min
			23:58	37	16.953	32	14.205	2076	wire out at 30m/min
		02 Oct 92	0:02	37	16.873	32	14.266	2075	wo = 1900, p = 1692, winch stopped
			0:05	37	16.786	32	14.275	2071	sled sinking down slowly, in slight plume!!!
			0:36	37	16.811	32	14.651	1944	wo = 1900, p = 1855, haul in at 60m/min
			0:51	37	16.850	32	14.608	**1928**	wo = 1034, p = 1050, pay out at 60m/min
									starting off for WP3 (start &finish point)
									in definite plume,
									different height than dredge plume
									wo = 1703, stopping winch
									wo = 1703, p = 1702, wire out 60m/min
				37	16.898	32	15.007	1951	wo = 1800, p = 1774, fired bottle #1, no confirm
			1:16	37	16.900	32	15.038	1937	wo = 1800, p = 1769, wire in at 60m/min
			1:31	37	17.115	32	15.356	1753	wo = 1000, p = 896, stopped winch
			1:32	37	17.125	32	15.386	1746	wo = 1000, wire out at 60m/min to p = 1500
			1:41	37	17.203	32	15.546	1716	wo = 1504, p = 1393, stopped winch
			1:42	37	17.221	32	15.556	1714	wire out at 20m/min
			1:45	37	17.280	32	15.629	1708	wo = 1580, p = 1470, wire out at 60m/min
			1:48	37	17.321	32	15.681	1700	wo = 1716, p = 1600, wire in at 60m/min
			1:59	37	17.376	32	15.868	1680	wo = 1050, p = 983, stopped winch
			2:01	37	17.408	32	15.887	1676	wo = 1050, p = 988, wire out at 60m/min
									WP #4: 37° 18.0' N 32° 17.0' W 1600m
									WP #5: 37° 17.5' N 32° 16.6' W 1740m
									WP #6: 37° 17.0' N 32° 16.9' W 1560m
									WP #7: 37° 15.0' N 32° 17.6' W 2100m
			2:09	37	17.437	32	15.967	1627	wo = 1502, p = 1433, stopped winch, at WP #3
			2:17	37	17.577	32	15.976	1629	wo = 1500, p = 1493, paying out @ 10m/min
			2:23	37	17.564	32	15.962	1620	wo = 1556, p = 1563, hauling in @ 60m/min
			2:36	37	17.602	32	15.991	1619	wo = 800, p = 804, pay out @ 60m/min
			2:51	37	17.671	32	16.278	1571	wo = 1556, p = 1523, hauling in @ 60m/min
			3:00	37	17.771	32	16.494	1586	wo = 1046, p = 963, paying out @ 60m/min

	A127-193-SL23	02 Oct 92	3:12	37	17.940	32	16.789	1650	wo=1707, p=1554, hauling in @ 60m/min
			3:19	37	17.983	32	16.947	1592	approaching WP #4
			3:22	37	17.995	32	17.004	1590	wo=1141, p=1000, stopped winch, kiting down
									nephelometer has gotten progressively noiser
			3:32	37	17.995	32	17.052	1601	wo=1141, p=1100, paying out @ 60m/min
			3:40	37	18.041	32	16.964	1597	wo=1543, p=1553, hauling in @ 60m/min
			3:50	37	17.839	32	16.902	1614	wo=1009, p=990, paying out @ 60m/min
			4:00	37	17.600	32	16.774	1715	wo=1600, p=1501, stopped winch
			4:12	37	17.470	32	16.608	1662	wo= 1600, p=1435, haul in @ 60m/min
			4:14	37	17.495	32	16.649	1711	wo=1465, p=1375, stopped winch, WP #5
			4:17	37	17.496	32	16.623	1697	wo=1465, p=1425, paying out @ 30m/min
			4:22	37	17.440	32	16.593	1669	wo=1600, p=1578, stopping winch
			4:27	37	17.344	32	16.656	1690	wo=1600, p=1514, haul in @ 60m/min
			4:35	37	17.167	32	16.676	1625	wo=1082, p=997, paying out @ 60m/min
			4:43	37	16.997	32	16.847	1557	wo=1503, p=1346, stopped winch, WP #6
			4:58	37	17.017	32	17.025	1556	wo=1503, p=1480, hauling in @ 60 m/min
			5:06	37	17.856	32	17.073	1644	wo=1070, p=998, paying out @ 60 m/min
			5:18	37	16.533	32	17.200	1776	wo=1707, p=1550, hauling in @ 60m/min
			5:28	37	16.371	32	17.279	1783	wo=1192, p=1000, paying out @ 60 m/min
			5:41	37	16.054	32	17.410	1808	wo=1914, p=1654, hauling in @ 60m/min
			5:53	37	15.798	32	17.532	1835	wo=1223, p=995, paying out @ 60 m/min
			6:08	37	15.507	32	17.661	1896	wo=2046, p=1750, hauling in @ 60m/min
			6:21	37	15.152	32	17.895	1873	wo=1258, p=1000, stopped winch, WP #7
			6:30	37	15.201	32	17.776	1884	wo=1258, p=1200, paying out @ 60 m/min
			6:40	37	15.260	32	17.805	1910	wo=1834, p=1850, hauling in @ 60m/min
			6:42	37	15.232	32	17.802	1899	wo=1750, p=1755, stopped winch
			6:52	37	15.118	32	17.789	1902	wo=1750, p=1745, paying out @ 30 to wo=1800
			6:54	37	15.121	32	17.785	1896	wo=1800, p=1800, stopped winch
			6:57	37	15.099	32	17.782	1892	wo=1800, p=1810, paying out @ 20
			6:58	37	15.100	32	17.777	1883	wo=1833, p=1840, hauling in @ 60
			7:00	37	15.098	32	17.760	1890	wo=1750, p=1766, stopped winch, leaving WP #7
			7:01	37	15.090	32	17.741	1886	wo=1750, p=1766, hauling in @ 60
									WP #8: 37° 14.0' N 32° 19.2' W
			7:14	37	14.862	32	18.020	1948	wo=1008, p=950, paying out @ 60
			7:30	37	14.628	32	18.277	1981	wo=1957 , p=1800, hauling in @ 60
			7:44	37	14.455	32	18.579	2079	wo=1159, p=1000, paying out @ 60
			8:04	37	14.111	32	19.031	2143	wo=2251 , p=1950, hauling in @ 60
			8:08	37	14.045	32	19.149	2159	wo=2050, p=1710, Stopped winch, at WP #8

	A127-193-SL23	02 Oct 92	8:21	37	14.026	32	19.240	2173	wo = 2050, up 100m
			8:23	37	14.034	32	19.224	2169	wo = 1950, back down 100m
			8:25	37	14.048	32	19.215	2168	wo = 2050, p = 1950, up 100m
			8:31	37	14.005	32	19.253	2171	fire bottle #2, p = 1973, up 50 m
			8:34	37	13.975	32	19.230	2163	fire bottle #3, p = 1919, upto p = 1800
			8:38	37	13.965	32	19.210	2170	fire bottle #4, p = 1808, upto p = 1600
			8:42	37	14.010	32	19.289	2171	fire bottle #5, p = 1600
			8:46	37	13.967	32	19.200	2168	fire bottle #6, p = 1400, up @ 40m/min
			9:19	37	14.139	32	19.187	2129	winch stopped at p = 98, wo = 100
			9:21	37	14.142	32	19.190	2170	starting to the surface
			9:22	37	14.155	32	19.200	2174	surface, deck unit off
			9:23	37					on deck
end	A127-193-SL23	02 Oct 92	9:24	37	14.181	32	19.193	2176	sled program and seasoft stopped
									all bottles fired!
begin	A127-196-SL24	02 Oct 92	11:36	37	14.138	32	19.082	2156	in the water, deck unit on
									p = 2, everything looks okay
			11:38	37	14.179	32	19.083	2153	starting down, 20 m/min
			12:11	37	13.993	32	19.130	2165	ZAPS showing a cont. decr. in V with depth, p = 1250
			12:26	37	13.987	32	19.200	2172	p = 2114, wo = 2087, winch stopped
			12:33	37	13.955	32	19.232	2175	beginning tow toward wp #1, haul in @ 60 m/min
									wp #1 = 37° 16.2'N 32° 21'W
			12:51	37	14.311	32	19.431	2161	wo = 1070; p = 1000; down at 60m/min
			13:11	37	14.708	32	19.775	2073	wo = 2183, p = 1999, winch stopped
			13:12						up at 60 m/min
			13:29	37	14.976	32	20.019	2113	winch stopped at p = 1000, wo = 1158
			13:30	37	14.988	32	20.028	2114	down at 60 m/min
			13:42						nephelometer becoming noisier again
			13:48	37	15.325	32	20.306	2121	p = 2000, c/s to 30 m/min
			13:50	37	15.344	32	20.305	2113	winch stopped, wo = 2248, p = 2050
			13:51						up at 60 m/min
			14:12	37	15.678	32	20.617	2094	winch stopped, p = 900, wo = 1057; down @ 60 m/min
			14:34	37	16.183	32	20.884	2048	wo = 2212; p = 1916; winch stopped
									coming around to waypoint #1
			14:42	37	16.224	32	20.987	2000	up at 60 m/min
			15:06	37	16.111	32	20.857	2053	winch stopped at p = 800, wo = 801
			15:08	37	16.098	32	20.837	2057	down at 60 m/min
									1350 to 1390m transition to higher Mn

	A127-196-SL24	02 Oct 92	15:27	37	16.217	32	20.997	1986	slowing to 30 m/min, p=1900, wo=1898
			15:29	37	16.183	32	20.977	1997	p=1950, wo=1931, winch stopped
			15:37	37	16.213	32	20.854	2032	heading toward waypoint #2 = 37°16.4N 32°20.2W
									waypoint #3 = 37°16.5N 32°19.3W
			15:40	37	16.213	32	20.739	2026	winch still stopped, waiting for sled to kite
			15:40	37	16.214	32	20.715	2032	in at 50 m/min
			15:59	37	16.405	32	20.244	1972	wo=1114, p=995, winch stopped
			16:03	37	16.447	32	20.116	2021	up to p=900, 50 nm/min
			16:04	37	16.464	32	20.059	2000	winch stopped, p=898, wo=1056
									down at 60 m/min
			16:22	37	16.457	32	19.597	1932	p=1850, wo=2052, winch stopped
			16:23	37	16.453	32	19.579	1928	up at 60 m/min
									waypoint #4 = 37° 17.5N 32° 17.0W (DR15 site)
									waypoint #5 = 37°18.7'N 32°18.1'W
			16:34	37	16.478	32	19.310	1903	approaching waypoint #3
			16:35	37	16.535	32	19.298	1908	p=1200, came out of top of plume; no dstinction bet
									upper and lower plumes
			16:44	37	16.493	32	19.296	1893	wo=915, p=904, winch stopped
			16:46	37	16.491	32	19.317	1901	on station at waypoint #3, down at 50 m/min
			16:58	37	16.411	32	19.259	1931	winch stopped, p=1500, wo=1486
									down another 50 m
			17:02	37	16.405	32	19.211	1929	wo=1536;p=1550; winch stopped
			17:04	37	16.405	32	19.199	1937	heading toward waypoint #4, up at 50 m/min
			17:11	37	16.477	32	19.015	1979	winch stopped at p=1200, wo=1215
			17:12	37	16.486	32	18.998	1975	down at 50 m/min
			17:16	37	16.500	32	18.600	1926	p=1460, strange spike in transmissometer
			17:19	37	16.542	32	18.842	1919	wo=1593, p=1550, winch stopped
									up at 50 m/min
			17:27	37	16.625	32	18.676	1841	winch stopped at p=1200, wo=1265
			17:29	37	16.647	32	18.646	1838	back down at 50 m/min
									stop/start seasoft with different parameters
			17:42	37	16.856	32	18.307	1810	winch stopped at p=1700, wo=1862
									up at 50 m/min
			17:53	37	17.031	32	18.055	1780	wo=1429, p=1200, winch stopped; out at 50 m/min
									ZAPS almost off scale at p=1500
			18:06	37	17.271	32	17.640	1772	stopping at p=1650, wo=2030; and back out at 50
			18:17	37	17.389	32	17.346	1753	stopped at p=1200, wo=1549; down at 50 m/min
			18:29	37	17.536	32	17.063	1682	stopping at p=1625, wo=2041, hauling in at 96 m/min

	A127-196-SL24	02 Oct 92							ZAPS off scale at p=1360
			18:49	37	17.460	32	16.896	1736	wo=920, p=895, winch stopped
			18:52	37	17.470	32	16.875	1739	down at 50 m/min
			19:07	37	17.397	32	16.803	1714	up at 50m/min, p=1700, wo=1618
			19:42	37	17.539	32	16.887	1741	surface
End	A127-196-SL24	02 Oct 92	19:45	37	17.542	32	16.898	1741	on deck, no bottles fired
Begin	A127-199-SL25	02 Oct 92	21:50	37	16.789	32	14.494	2029	in water, CG pump on, Zaps on wo cartridge
			21:59	37	16.772	32	14.572	2022	going down @ 25
			22:03	37	16.796	32	14.505	2021	going down @ 40
			22:32	37	16.838	32	14.579	1925	wo=1776,stopped winch, looking for particle layer
			22:34						going down @ 60 to wo=1870
			22:36						wo=1871, comin up
			22:39						started new 'tow' file vs time
			22:42	37	16.861	32	14.527	1928	up 100m (1.5knots to WP2: 37° 17' N 32° 15'W)
			22:44	37	16.867	32	14.496	1936	goin down to wo=1800
			22:46	37	16.889	32	14.487	1985	wo=1800, stopping winch
			22:48	37		32			goin down 25 m, 12 min to pump on
			22:49	37	16.913	32	14.496	2001	p=1847, wo=1827, winch stoped
			22:51	37	16.909	32	14.519	1994	back up 75 m
				37		32			wo=1771, p=1795, winch stopped
			22:55	37	16.930	32	14.547	1964	coming up 150m (5 min to pumpkin time)
			22:57	37	16.937	32	14.588	1939	wo=1626, going down, saw background part. layer!
			23:00	37	16.921	32	14.640	1932	fire bottle #1, p=1800
									pump on!! Was in the layer the whole time!!
			23:00	37	16.912	32	14.664	1933	fire bottle #2, fired same time as pump started
				37		32			going down 5m, holding p=1800
			23:04	37	16.936	32	14.719	1951	going down 10m
			23:11	37	16.971	32	14.842	1959	going down 10m
			23:11						wo=1806, stopped winch
			23:20						going down 10m, stopped at wo=1844
			23:25	37	17.001	32	15.014	1945	hauling in 100m to check we are still in layer
			23:28	37	16.971	32	14.983	1954	wo=1702, p=1700, going down 150m
			23:31	37	16.978	32	14.921	1959	wo=1834, p=1850, coming up to1800
			23:31						wo=1779, p=1800, stopped winch
			23:48	37	16.855	32	14.678	1956	going down 15 m
			23:57	37	16.818	32	14.549	1931	fire bottle #3, p=1801, midway through pump
			23:58	37	16.812	32	14.550	1939	fire bottle #4, p=1797, midway through pump

	A127-199-SL25	03 Oct 92	0:05	37	16.799	32	14.472	2031	goin down 20m, stopped @ wo=1818
									going down 40m, more part. deeper?,
			0:07	37	16.819	32	14.454	2027	wo=1858, p= 1860, winch stopped, up 20m
									wo=1838, p= 1844, winch stopped
			0:10	37	16.825	32	14.454	2026	coming up 30m
			0:18	37	16.795	32	14.491	2026	wo=1792, p=1806, coming up 120m @ 60 m/min
			0:20	37	16.802	32	14.476	2038	wo=1722,p=1746, part. dec., down again
			0:22	37	16.807	32	14.477	2026	wo=1825, p=1850, up to wo=1790
			0:29	37	16.824	32	14.469	2011	coming up 10m, stopped at wo=1774, p=1800
			0:53	37	16.826	32	14.450	2019	fire bottle #5, p=1799 pump off, wo=1774
			0:54	37	16.838	32	14.471	2020	fire bottle #6, p=1799 pump off, wo=1774
			0:58	37	16.855	32	14.554	1966	going down 150m @ 60m/min, on new file
			1:00	37	16.827	32	14.542	1967	wo=1900, p=1930, coming up at 60, final haul
			1:37	37	16.799	32	14.473	2034	sled at surface, deck unit off
end	A127-199-SL25	03 Oct 92	1:39	37	16.837	32	14.488	2023	sled on deck
									tightened bungies in bottles 1-4 (they leaked on deck)
Begin	A127-202-SL26	03 Oct 92	4:32	37	18.720	32	18.142	1623	in water, going down, deck unit on
			5:07	37	18.707	32	18.132	1638	at bottom, 1580m wo coming up @60 to 1400m
									setting off to WP1: 37° 20.7' N 32° 18.0'W
			5:17	37	18.678	32	18.181	1614	going down @60
									p=1530, wo=1534, winch stopped
									wo=1530, hauling in @ 60
			5:29	37	18.963	32	18.177	1589	in nice ZAPS plume! centered at p=1450
			5:30	37	18.985	32	18.149	1596	paying out @ 60
									wo=1593, p=1460, stopped winch
			5:41	37	19.202	32	18.173	1545	haulin in @ 60
			5:43	37	19.245	32	18.166	1564	wo=1601, p=1465, stopped winch, at plume bound
									at bottom boundary of plume at 100 mab, p=1465
			5:46	37	19.340	32	18.130	1615	pay out 10m
			5:47	37	19.378	32	18.095	1655	pay out 100m
			5:50	37	19.416	32	18.109	1698	wo=1721, p=1566, winch stopped
			5:52	37	19.455	32	18.095	1743	down 10m
			5:54	37	19.487	32	18.081	1770	down another 20m
									down another 50m, trying to hold d=1550m (NOT p)
			5:58	37	19.605	32	18.100	1817	wo=1805, p=1565, stopped winch
			6:00	37	19.639	32	18.078	1824	paying down towards bottom
			6:01	37	19.659	32	18.091	1825	did a "moser" !!! LT wigged out - hit bottom!?

	A127-202-SL26	03 Oct 92							hauling in...
			6:05	37	19.715	32	18.108	1827	wo = 1700, p = 1480, winch stopped
									up 20m
			6:07	37	19.746	32	18.104	1826	wo = 1680, winch stopped, trying to hold to d = 1450
			6:12	37	18.848	32	18.079	1829	hauling in 350m @ 70
			6:18	37	19.959	32	18.129	1800	wo = 1315,p = 1107, turned wire around, down @70
									wo = 1650, d = 1370, winch stopped
			6:49	37	20.701	32	18.018	1727	coming up @ 60, d = 1283, at WP1
			6:52	37	20.658	32	18.071	1724	increasing to 70m/min
			6:57	37	20.701	32	18.063	1739	wo = 1182,d = 1018, paying out @ 60
			7:06	37	20.767	32	18.055	1766	wo = 1651, stopping winch
			7:16	37	20.737	32	18.058	1751	going down @ 20
			7:19	37	20.772	32	18.052	1770	wo = 1699, d = 1670
									setting off for WP2: 37° 20.9' N 32° 20.8' W
			7:28	37	20.871	32	18.210	1830	come up @ 70 to p > 1300
									p = 1380, getting to clean water according to LT
			7:35	37	20.750	32	18.406	1952	wo = 1321, p = 1250, d = 1236, going down @ 70
									wo = 1800, p = 1660, d = 1650, slowing to 20 m/min
			7:51	37	20.636	32	18.785	2122	wo = 1957, p = 1800, d = 1778, winch stopped
			7:53	37	20.592	32	18.821	2121	coming upto d = 1450 @ 70
			7:59	37	20.480	32	18.994	2110	arrived @ 1450m depth, winch stopped
			8:10	37	20.339	32	19.216	2130	going down 20m to 1450 depth
									changing heading, bridge had 20.0' N and 20.0' W
			8:17	37	20.219	32	19.414	2138	going down to wo = 2000
			8:23	37	20.301	32	19.596	2154	wo = 2086, coming up @ 70
			8:25	37	20.286	32	19.644	2158	wo = 2058, p = 1750, going down @ 20
			8:32	37	20.349	32	19.826	2122	wo = 2188, p = 1850, winch stopped
			8:38	37	20.436	32	19.994	2079	pay out 50m
			8:42	37	20.499	32	20.110	2137	wo = 2232, p = 1835, coming up 350m @70
									STOPPED AT P = 1400
			9:14	37	20.875	32	20.815	1887	haul in @ 50
				37		32			winch stopped at 1400, wo = 1751
			9:46	37	21.109	32	20.746	1950	p = 1655, wo = 1751, sled falling below ship
			10:13	37	21.222	32	20.187	2171	down at 50 m/min
			10:15						p = 1793; wo = 1886; winch stopped
			10:19	37	21.312	32	20.215	2173	starting down at 50m/min
			10:24	37	21.307	32	20.237	2172	winch stopped wo = 2100
			10:34	37	21.264	32	20.187	2172	down to 2130 depth at 30m/min

	A127-202-SL26	03 Oct 92	10:36	37	21.279	32	20.225	2171	wo=2154;p=2159;fire Bottle#1 (z=2135)
			10:39	37	21.290	32	20.262	2171	up at 50 m/min
			10:47	37	21.257	32	20.280	2168	wo=1748, p=1771, fire bottle #2 (z=1750)
									up at 50 m/min
			10:54	37	21.302	32	20.342	2142	wo=1448, p=1464, fire bottle #3 (z=1450)
									up at 50 m/min; seasoft placed an event mark
			11:04	37		32			wo=1000, p=1010, fire bottle #4 (z=1000)
									up at 50 m/min
			11:16	37	21.264	32	20.341	2131	wo=500;p=504; fire bottle #5 (z=500m) up at 50
			11:27	37	21.313	32	20.302	2153	wo=50;p=50;fire bottle#6(z=50m)
			11:31	37	21.319	32	20.279	2154	surface
end	A127-202-SL26	03 Oct 92	11:34	37	21.340	32	20.242	2160	on deck
Begin	A127-208-SL27	03 Oct 92	17:04	37	22.312	32	22.039	1811	in water...no data from deck unit, bringing it back
			17:15	37	22.394	32	21.945	1801	on deck
			18:26	37	22.321	32	21.950	1820	back in water; ZAPS signal is noisy
									WP1 37°22'N/32°18.5'W
									WP2 37°21.5'N/32°15'W
									WP3 37°21'N/32°12'W
									WP4 37°21
			18:35	37	22.431	32	22.038	1816	deck unit OK, down @ 50
			19:08		22.342		22.055	1792	winch stopped at p=1720, wo=1697
									seasave stopped/started for tow
			19:13	37	22.284	32	22.040	1786	down at 30 m/min; ZAPS getting quieter
			19:17	37	22.289	32	22.023	1792	z=1750, p=1772, wo=1747, starting up @ 50
			19:32	37	22.161	32	21.541	1866	z=879, p=885, wo=973, out @50 m/min
			19:42	37	22.226	32	21.107	2016	just passed 2000 m centerbeam
			19:47	37	22.145	32	20.921	2093	z=1450, wo=1675, bottle #1 fired
			19:54	37	22.135	32	20.697	2089	bottle #2 fired at z=1750, wo=1975, p=1777
			19:55	37	22.128	32	20.692	2099	up @ 50, wo=2022, p=1825, z=1804
			20:15	37	22.116	32	20.175	2144	down @50, p=900, z=892, wo=1044
			20:40	37	21.979	32	19.595	2095	up @ 50, z=2000, p=2027, wo=2210
			21:02	37	21.977	32	18.940	2174	down @ 50, p=900, z=893, wo=1060
									20:00 local time - the changing of the guard
			21:25	37	21.997	32	18.429	2215	wo=2050, p=1890, z=1870, stopped winch
			21:31	37	21.955	32	18.391	2222	going down 100m @50
			21:33	37	21.960	32	18.373	2217	wo=2150, p=2070, z=2040, coming in

	A127-208-SL27	03 Oct 92	21:34	37	21.949	32	18.376	2222	wo=2100, winch stopped
			21:45	37	21.881	32	18.415	2232	going down to wo=2150 @ 50
			21:46	37	21.871	32	18.439	2219	wo=2150, coming in @50 upto p=900
			22:12	37	21.810	32	18.451	2203	p=900, wo=905, z=908, leaving WP1, winch off
									going down @ 50
			22:36	37	21.923	32	18.022	2096	wo=2071, turn wire around,p=2020, z=1995
			22:53	37	21.884	32	17.582	2141	just came through ZAPS and LT max at z=1450
			22:59	37	21.904	32	17.402	2119	wo=1004, p=903, z=900, reverse: going dwn @50
			23:23	37	21.887	32	16.745	2210	wo=2234, p=2034, z=2000, reverse: up @50
			23:47	37	21.777	32	16.083	2340	wo=1056, p=904, z=896,reverse, down @ 50
			23:59	37	21.702	32	15.751	2281	firing bottle #3 at z=1450
				37	21.79	32	16.25		fish position according to sled program
		04 Oct 92	0:06	37	21.673	32	15.579	2278	firing bottle #4 at z=1750
				37	21.79	32	16.25		fish position according to sled program
			0:11	37	21.659	32	15.458	2373	wo=2263, p=2025, z=2000, reverse: up @50
			0:32	37	21.546	32	14.985	2490	arrived at WP2, ship slowing
									hauling up to wo=900 @ 50
			0:39	37	21.576	32	15.025	2490	wo=901, p=891, z=883, reverse: down @ 50
			1:10	37	21.517	32	14.999	2487	wo=2400, p=2434, z=2402, reverse: up @ 50
			1:39	37	21.567	32	14.191	2490	wo=1006 , p=900, z= 893, reverse: down @ 50
			2:08	37	21.404	32	13.472	2318	wo=2419 , p=2229 , z=2201, reverse: up @50
			2:37	37	21.167	32	12.888	2243	wo=998, p=900, z=891, reverse: down @ 50
			2:57	37	21.126	32	12.435	1955	wo=1950, p=1830, z=1807, reverse: up @ 50
			3:11	37	21.181	32	12.165	1934	wo=1278, p=1181, 1173m, reverse: down @ 50
			3:23	37	20.979	32	12.018	1913	wo=1800, at WP 3, p=1714, z=1695, winch off
			3:35	37	21.026	32	12.102	1923	p=1796, going down @50
			3:36	37	21.036	32	12.120	1921	wo=1860, p=1862, z=1841, coming up @50
			3:37	37	21.076	32	12.130	1940	firing bottle #5 at z=1750
				37	21.07	32	12.15		fish position according to sled program
			3:43	37	21.170	32	12.084	1882	firing bottle #6 at z=1450 (Seasave marked blank!)
				37	21.18	32	12.08		fish position according to sled program
			3:45	37	21.162	32	12.051	1876	heading off to WP #4
			3:56	37	21.083	32	11.942	1906	wo=1904, p=900, z=892, reverse: down @ 50
			4:09	37	21.010	32	11.592	1947	wo=1550, p=1499, z=1583, reverse: up @ 50
			4:20	37	20.879	32	11.383	1631	wo=1588, p=1500, z=1485
			4:22	37	20.901	32	11.347	1600	ship slowing, final haul in @ 50
			4:59	37	21.371	32	11.525	1915	sled at surface, deck unit off
End	A127-208-SL27	04 Oct 92	5:02						sled on deck

Begin	A127-213-SL28	04 Oct 92	13:32	37	22.456	32	17.494	2215	in the water
			13:38	37	22.441	32	17.526	2211	sled looks OK, down @ 50 to about 2150
			13:42	37	22.474	32	17.431	2219	slowed to 25m/min; ZAPS looks noisy
			13:53	37	22.464	32	17.283	2171	down @ 50 m/min
			14:24	37	22.356	32	17.475	2214	change seasave to tow mode
			14:27	37	22.369	32	17.517	2204	up @ 50 m/min, z = 2152, p = 2180, wo = 2163
			14:52	37	21.982	32	17.246	2118	down @ 50 m/min; p = 900, z = 889, wo = 966
			15:19	37	21.380	32	16.783	2164	aborting this tow, slowing to hold station
			15:21	37	21.360	32	16.810	2164	up @ 50 m/min; p = 2113, z = 1989, wo = 2298
									ZAPS still noisy, coming to the surface
									Transmissometer got quieter at p = 1050...?
			16:04	37	20.892	32	16.288	2272	p = 95, z = 97, wo = 99; winch stopped
									up at 35 m/min
			16:08	37	20.881	32	16.235	2251	surface
			16:11	37	20.882	32	16.204	2236	on deck
End	A127-213-SL28	04 Oct 92	16:42						on deck test 'TST_4OCT.DAT'
									cleaned ZAPS inlet, added grounding strap, redeploy
Begin	A127-213-SL29	04 Oct 92	17:08	37	21.377	32	17.003	2121	in water, deck unit on
			17:18	37	21.293	32	16.977	2105	still some noise; down at 30 m/min
									p = 400; ZAPS jumped to 0, returned slowly to approx. 3.5
			17:41	37	21.316	32	16.773	2132	wo = 1174, p = 1174, z = 1161; up @60
			17:59	37	21.195	32	16.688	2099	winch stopped at wo = 100, z = 87, p = 86
									continuing up @ 20 m/min
			18:01	37	21.163	32	16.701	2093	surface
End	A127-213-SL29	04 Oct 92	18:04	37	21.157	32	16.701	2099	on deck
Begin	A127-215-SL30	04 Oct 92	18:27	37	21.366	32	16.899	2123	back in water after removing Pb wts, deck unit on
			18:37	37	21.310	32	16.902	2111	down @ 20, easing up to 50, to 2050-2100m
			19:27	37	21.296	32	16.922	2095	up @ 50; z = 2050, p = 2078, wo = 2056
			19:46	37	21.095	32	16.612	2212	down @ 50; wo = 1221, z = 1187, p = 1200
			20:05	37	20.800	32	16.244	2226	up @ 50; z = 2074, p = 2100, wo = 2225
			20:22	37	20.502	32	15.867	2181	down @ 50; z = 1188, p = 1200, wo = 1406
			20:43	37	20.221	32	15.383	2191	up @ 50; wo = 2370, z = 2070, p = 2100

	A127-215-SL30	04 Oct 92	21:09	37	20.067	32	14.984	2164	down @ 50; wo=2132, z=1095, p=1107
									~08:00 local time: changing of the guard....
									sea state has been rougher tonight- is that why LT
									signal is getting broader??
			21:30	37	19.962	32	14.926	2223	wo=2150, p=2179, z=2150, reverse: up @ 50
									off to WP 2: 37° 17.6'N 32° 16.2' W
			21:48	37	19.545	32	15.246	2106	wo=1342, p=1200, z=1190, reverse: down @ 50
			22:07	37	18.788	32	15.625	1884	wo=2241, p=1557, z=1535, reverse: up @ 50
			22:21	37	18.600	32	15.862	1841	letting wire catch up, holding station, bringing in
			22:24	37	18.610	32	15.918	1837	wo=1650, p=1230, z=1222, winch off
			22:35	37	18.511	32	16.008	1820	wo=1650, p=1417, z=1405, dwn to wo=1750 @20
									problem is ship can either go fast (~2.5 kts) or hold
									station due to rough weather. Hard getting sled deep
									w/o paying out to much wire, about to go up a cliff
			22:43	37	18.443	32	15.941	1833	wo=1840, p=1736, z=1716, up @40
			22:45	37	18.447	32	15.908	1835	seting off again for WP2
			22:49	37	18.346	32	15.944	1836	wo=1627, p=1550, z=1530, winch stopped
			23:19	37	17.584	32	16.170	1610	wo=1627, p=1328, z=1414, up @40, final haul
									firing all 6 bottles, no H20 sampling though
									mark on position #1 (bottle #1) only
			23:57	37	17.794	32	16.050	1647	at surface, deck unit off
End	A127-213-SL30	05 Oct 92	0:00	37	17.837	32	16.019	1662	Rosebud on deck
Begin	A127-216-SL31	05 Oct 92	5:09	37	16.855	32	14.459	2042	In water, CG's pump on, want it at p=1000 @ 5:30
			5:32	37	16.770	32	14.550	1954	fire bottle #1, wo=800, p=825, z=817, pump on!
			5:35	37	16.766	32	14.564	1937	fire bottle #2, wo=935, p=967, z=956
			5:37	37	16.811	32	14.590	1922	bottle #3, wo=1050, p=1075, z=1065, winch off
			6:25	37	16.811	32	14.451	2041	bottle #4, wo=1070, p=1081, z=1072, mid-pump
			7:22	37	16.741	32	14.506	1986	bottle #5, wo=1063, p=1072, z=1060, end pump.
			7:26	37	16.717	32	14.524	1955	bottle #6, wo=1063, p=1067, z=1054
									marks made on last five firings
			7:28	37	16.702	32	14.525	1973	bringing her up @ 40!
									last bottle, #6, went down half open
									fire light came on, marked in seasave for no reason
									wo=95, p=90, z=90
			8:02	37	16.789	32	14.488	1993	Rosebud at surface
End	A127-216-SL31	05 Oct 92	8:05	37	26.737	32	14.477	2022	On deck

Begin	A127-234-SL32	07 Oct 92	2:18	36	23.119	33	39.489	2602	In water.
			2:20	36	23.142	33	39.500	2596	Deck unit on, all OK.
			2:25	36	23.150	33	39.512	2593	Going down
			2:40	36	23.138	33	39.529	2605	wo = 441, p = 445, z = 442 ? got screen bottle mark??
			2:54	36	23.054	33	39.451	2606	deck unit froze up, wo = 1106, p = 953, winch off
			2:59	36	23.055	33	39.486	2617	replaced fuse - no change, coming up
			3:23	36	23.228	33	39.529	2602	at surface
End	A127-234-SL32	07 Oct 92	3:27	36	23.289	33	39.576	2604	on deck
									sled reversed when in water and came up that way -
									backwards. Bottle position still on 12 (what it went
									down on).
									PROBLEM IDENTIFIED: SHORT IN CONDUCTING CABLE
									AT TERMINATION/SPLICE RE-DONE, READY TO GO.
Begin	A127-236-SL33	07 Oct 92	5:23	36	23.122	33	39.484	2586	In water
			5:25	36	23.101	33	39.488	2589	Deck unit on, all OK, going down.
									WP1: 36°22.4'N 33°37.8'W
									WP2: 36°23.3'N 33°37.5'W
									WP3: 36°24.1'N 33°36.6'W
									WP4: 36°27.4'N 33°37.3'W
									WP5: 36°29.4'N 33°36.6'W ZAPS noisy
			5:59	36	23.119	33	39.521	2605	p = 1700, z = 1680, top of nephel. & LT signals!!
			6:07	36	23.195	33	39.549	2613	p = 2225, z = 2205, bottom of nephel. & LT signal
			6:15	36	23.174	33	39.548	2607	stopped at 2550m wire out, up to 2500m wo.
			6:17	36	23.146	33	39.522	2603	starting tow to WP1, haul back up to p = 1950 @ 60
									p = 1950, reverse, going down
									wo = 2006, z = 1969, winch stopped, kiting up
			6:31	36	23.083	33	39.297	2643	letting out 50m wire
			6:32	36	23.065	33	39.275	2640	wo = 2055, p = 2027, z = 2003, winch stopped
			6:46	36	22.902	33	38.922	2612	p = 1900, z = 1885, paying out 50m wire
			6:49	36	22.850	33	38.830	2572	wo = 2230, p = 2000, z = 1977, winch stopped
			6:58	36	22.786	33	38.612	2530	p = 1946, z = 1922, coming up 100m
			7:01	36	22.751	33	38.520	2529	wo = 2030, p = 1740, z = 1720, reverse, going down
			7:07	36	22.688	33	38.371	2496	wo = 2307, p = 1962, z = 1941, winch stopped
			7:23	36	22.556	33	38.045	2401	wo = 2307 , p = 1900, z = 1876, coming in @ 50
			7:32	36	22.460	33	37.870	2373	wo = 1880, p = 1500, z = 1480, winch off, at WP1
			7:36	36	22.419	33	37.803	2396	wo = 1880, p = 1500, z = 1491, going down @25

	A127-236-SL33	07 Oct 92	7:57	36	22.389	33	37.797	2400	wo = 2400, p = 2305, z = 2276, up @ 50
			8:02	36	22.404	33	37.801	2398	wo = 2197, p = 2150, z = 2124, winch stopped
									leaving for WP2, coming in slow @20
			8:06	36	22.465	33	37.790	2396	wo = 2133, p = 2127, z = 2100, winch stopped
			8:13	36	22.585	33	37.735	2364	up 10m to wo = 2123, p = 2134, z = 2108
			8:17	36	22.703	33	37.715	2339	pay out 15m to wo = 2138, p = 2125, z = 2099
			8:23	36	22.794	33	37.682	2322	down 10m to wo = 2148, p = 2131, z = 2104
			8:25	36	22.891	33	37.653	2317	down 20m to wo = 2168, p = 2126, z = 2099
			8:29	36	22.936	33	37.617	2318	down 15m to wo = 2183, p = 2123, z = 2096
			8:31	36	22.972	33	37.589	2308	down 20m to wo = 2203, p = 2127, z = 2101
			8:35	36	23.031	33	37.572	2306	down 20m to wo = 2224, p = 2140, z = 2114
			8:37	36	23.067	33	37.565	2308	up 10m to wo = 2209, p = 2130, z = 2106
			8:38						bringing up at 50
			8:43	36	23.185	33	37.518	2311	wo = 1979, p = 1878, z = 1853, reverse: going down
			8:48	36	23.258	33	37.473	2303	slowing to WP2
			8:48	36	23.262	33	37.476	2303	wo = 2251, p = 2136, z = 2109; winch stopped, on sta
			9:02	36	23.208	33	37.434	2307	up @ 20 m/min
			9:06	36	23.209	33	37.441	2305	winch stopped; wo = 2200, p = 2193, z = 2165
			9:11	36	23.264	33	37.457	2305	stopped/started seasave
			9:21	36	23.228	33	37.438	2301	winch stopped; wo = 2028, p = 2050, z = 2028
									down @ 20 m/min
			9:27	36	23.252	33	37.428	2306	wo = 2122, p = 2150, z = 2123; winch stopped
			9:29	36	23.249	33	37.427	2304	starting for next WP (#3)
			9:30	36	23.285	33	37.417	2299	down @ 50 m/min
			9:35	36	23.333	33	37.377	2302	up @ 20 m/min; wo = 2272, z = 2272, p = 2300
			9:43	36	23.465	33	37.196	2319	wo = 2145, p = 2135, 2109; down @ 20 m/min
			9:45	36	23.507	33	37.087	2296	wo = 2215, p = 2175, z = 2149; winch stopped
			9:52	36	23.665	33	36.928	2284	down at 30 m/min, p = 2111, z = 2087
			9:53	36	23.680	33	36.893	2278	wo = 2264, p = 2150, z = 2124; winch stopped
			10:04	36	23.777	33	36.630	2260	down @ 30 m/min; p = 2058, z = 2035
			10:09	36	23.914	33	36.549	2222	wo = 2424, p = 2146, z = 2116; winch stopped
			10:14	36	24.037	33	36.384	2209	in @ 20 m/min; p = 2097, z = 2070
			10:16	36	24.051	33	36.410	2227	slowing to WP3
			10:26	36	23.939	33	36.341	2241	wo = 2150, p = 1986, z = 1965; winch stopped, on sta
			10:32	36	23.865	33	36.291	2241	down @ 20 m/min; p = 2072, z = 2051
			10:34	36	23.865	33	36.291	2233	wo = 2200, p = 2148, z = 2123; winch stopped
			10:41	36	23.865	33	36.291	2214	up to the surface @ 50 m/min, p = 2180, z = 2155
									abandoning waypoints 4 and 5

	A127-236-SL33	07 Oct 92	11:20	36	24.263	33	36.874	2208	winch stopped at wo=100; continuing to the surface
			11:26	36	24.159	33	36.736	2221	surface
End	A127-236-SL33	07 Oct 92	11:28	36	24.187	33	36.758	2228	on deck
Begin	A127-237-SL34	07 Oct 92	11:46	36	24.268	33	38.020	2454	in the water
									event mark on screen when display appeared
									ZAPS voltage approx. 4.74
									transmit light on deck unit flashing every 1/2 sec.
									restarted Seasave, ZAPS voltage approx. 2.4
									transmit light on deck unit on, not flashing
									recovering sled
			12:04	36	24.245	33	38.118	2486	surface
			12:07	36	24.244	33	38.112	2480	on deck; disconnecting rosette
			12:17	36	24.299	33	38.051	2457	back in the water
			12:22	36	24.296	33	38.053	2456	wo=100, p=99, z=97; going down @ 50 m/min
			13:09	36	24.317	33	38.076	2465	winch stopped at wo=2450, p=2486, z=2453
									up @ 30 m/min
			13:13	36	24.327	33	38.015	2438	up @ 50 m/min
			13:57	36	24.322	33	37.959	2452	wo=100, p=99, z=100
			13:59	36	24.351	33	37.973	2454	surface
End	A127-237-SL34	07 Oct 92	14:02	36	24.360	33	37.987	2452	on deck
Begin	A127-241-SL35	07 Oct 92	17:00	36	25.800	33	37.738	2655	in the water
			17:08	36	25.782	33	37.727	2465	everything looks OK, on the way down @ 20 m/min
									increasing winch speed to 50 m/min
			17:55	36	25.790	33	37.701	2461	slowing to 20 m/min, p=2400
			17:58	36	25.795	33	37.719	2458	wo=2426, z=2427, p=2460, at the bottom
			18:00	36	25.806	33	37.733	2451	up @ 50 m/min
			18:50	36	25.839	33	37.695	2442	surface
End	A127-241-SL35	07 Oct 92	18:52	36	25.837	33	37.703	2443	on deck
Begin	A127-242-SL36	07 Oct 92	19:08	36	27.108	33	37.404	2308	in the water
									down @ 50 m/min

	A127-242-SL36	07 Oct 92	19:59	36	27.105	33	37.378	2318	wo=2275, p=2309, z=2280, winch off,
									at the bottom, new file started, up @ 50 m/min
			20:45	36	27.110	33	37.275	2263	winch stopped w/ 100 m wire out
									up @ 60 m/min to surface
End	A127-242-SL36	07 Oct 92	20:48	36	27.113	33	37.278	2266	on deck
Begin	A127-243-SL37	07 Oct 92	21:07	36	28.734	33	36.748	2289	in the water
									wo=33 coming up to wo=10, was waiting on comp.
			21:21	36	28.728	33	36.732	2273	wo=9, going down @50, nephel noisy
									LT signal not as big as at sled 35
			22:09	36	28.735	33	36.739	2268	wo=2250, p=2282, z=2254, winch off
			22:11	36	28.745	33	36.742	2267	new file, bringing up @50
			23:01	36	28.405	33	36.811	2291	on surface, deck unit off
End	A127-243-SL37	07 Oct 92	23:03	36	28.412	33	36.821	2281	on deck
Begin	A127-244-SL38	07 Oct 92	23:18	36	27.886	33	37.087	2282	in water, deck unit on
			23:20	36	27.897	33	37.103	2278	going down, all OK
		08 Oct 92	0:07	36	27.903	33	37.158	2304	wo=2250, p=2283, z=2254
									switch to tow file, up at 50m
			0:13	36	27.898	33	37.140	2295	wo=2062, p=2091, z=2065, winch stopped
			0:22	36	27.689	33	37.166	2256	going down 50m, p=2045
			0:23	36	27.657	33	37.187	2254	wo=2119, p=2091, z=2062, winch stopped
			0:33	36	27.472	33	37.209	2303	back down to wo=2171, p=2090, z=2066
			0:41	36	27.320	33	37.228	2317	down to wo=2238. p=2110, z=2080
									0.2 offset in LT between sled 36 & 37 at p=2150
			1:18	36	27.066	33	37.261	2267	down 10m to wo=2249, p=2252, z=2223
									28 m off bottom
			1:24						10 m off bottom
			1:25	36	27.101	33	37.246	2258	going down 10m, at 4m separation started up
									went up to p=2067, whoops! wanted p=2100, down
			1:31	36	27.113	33	37.166	2300	wo=2086, p=2100, z=2071, winch off
			1:45	36	27.467	33	37.131	2358	pay out to wo=2174, p=2116, z=2088, winch off
			1:50	36	27.625	33	37.197	2292	down to wo=2198, p=2101, z=2076, winch off
			1:56	36	27.747	33	37.192	2265	down to wo=2256, p=2100, z=2071, winch off
			2:00	36	27.837	33	37.156	2287	pay out 50m to wo=2308, p=2055, z=2030
									bringin in, trying to stay at p=2100

	A127-244-SL38	08 Oct 92	2:05	36	27.763	33	37.239	2321	wo=2210, p=2100, z=2076, winch off
			2:09	36	27.664	33	37.187	2271	coming up slow
			2:12	36	27.665	33	37.129	2253	coiming up quickly to p=2100
			2:14	36	27.679	33	37.138	2256	wo=2096, p=2100, z=2077, winch off
			2:18	36	27.767	33	37.186	2263	paying out @50
			2:20						wo=2200, p=2170, z=2145, pulling up @60
			2:21	36	27.845	33	37.236	2289	wo=2149, p=2129, z=2103
									going down to bottom @60
								2394	wo=2276, p=2240, z=2212, coming all the way up
									started new seasave file (saving the sea, we are...)
									at surface, deck unit off
End	A127-244-SL38	08 Oct 92	3:14	36	28.127	33	37.442	2548	on deck
Begin	A127-247-SL39	08 Oct 92	5:46	36	27.691	33	37.468	2283	in water w/ CG's pump, no ZAPS
			5:52						going down, but where are we?!?! --
									4 GPS fixes give roughly two different positions.
									going by bathymetry, want to be over cliff below us
			6:33	36	27.703	33	37.140	2289	wo=2207, p=2240, z=2212, winch off, new file
			6:41	36	27.720	33	37.160	2313	up to wo= p=2021, p=2050, z=2025
			6:43	36	27.721	33	37.160	2338	down to wo=2082, p=2112, z=2084, winch off
			6:52	36	27.677	33	37.160	2318	down to wo=2124, p=2150, z=2125, reverse:up
			6:54	36	27.662	33	37.131	2289	wo=2020, p=2045, z=2020, down now
			6:54	36	27.624	33	37.057	2265	wo=2068, p=2092, z=2067
			6:56	36	27.615	33	37.039	2256	fire bottle #1 p=2093, z=2067 RED MARK!
									blank RED MARK!!
			6:58	36	27.604	33	37.016	2270	fire bottle #2 p=2092, z=2067 RED MARK!
									blank RED MARK!! and confirms on all 4!!
			7:03	36	27.664	33	37.104	2267	pump start. wo=2062, p=2090, z=2065
			7:09						CTD froze up, no error light, turned off then on,
			7:10	36	27.683	33	37.083	2284	seasave restarted with new file, -?!??!
			7:49	36	27.821	33	37.168	2277	3 out of 4 GPSs agreeing, 4th not expected to
			7:55	36	27.813	33	37.158	2274	fire bottle #3 p=2091, z=2066 RED MARK!!
									blank RED MARK!!
			7:57	36	27.823	33	37.161	2281	fire bottle #4 p=2090, z=2065 RED MARK!!
									blank RED MARK!! and confirms on all 4!!
			8:50	36	27.689	33	37.170	2270	fire bottle #5 p=2082, z=2057 NO RED MARK!!
				36		33			blank NO RED MARK!!

	A127-247-SL39	08 Oct 92	8:51	36	27.696	33	37.177	2257	fire bottle #6 p=2082, z=2057 NO RED MARK!!
									blank NO RED MARK!! but confirms on all 4!!
									Realized why no red marks - screen frozen again.
									Was recieving data before bottles fired. Turned deck
									unit on and off several times - no avail
									system working again, back down to wo=2200
									system quit again, restarted program and deck unit
			9:04	36	27.681	33	37.188	2251	stopped at wo=2201, up @ 50 m/min
			9:45	36	27.628	33	37.183	2257	winch stopped @ wo=100 m, up @ 50 m/min to surf.
									program stopped again at p=494, z=490; no lights on
									the deck unit (except 'modem detect'), numbers not
									changing
End	A127-247-SL39	08 Oct 92	9:48	36	27.626	33	37.181	2260	on deck
Begin	A127-249-SL40	08 Oct 92	11:15	36	28.016	33	37.706	2514	in the water
			11:20	36	27.995	33	37.683	2515	down @ 50 m/min
			11:57	36	27.945	33	37.729	2541	program locked up, holding at 1850m wire out
			12:05	36	27.931	33	37.762	2544	up @ 50 m/min to wo=1700m
			12:09	36	27.982	33	37.762	2544	stopped at wo=1700 m
			12:11	36	27.966	33	37.759	2544	deck unit quit as soon as program opened
									changing Shark and deck unit interface cable
			12:22	36	27.970	33	37.731	2528	up to wo=1500 @ 50 m/min
									still working on deck unit, now there's apparently no
									info coming up from sled
			12:26	36	27.956	33	37.707	2524	winch stopped at wo=1530
			12:27	36	27.953	33	37.707	2522	up to wo=500 m @ 50 m/min
			12:35	36	27.979	33	37.745	2530	above wo=1400m, deck unit seems to be working OK
									stopping at wo=1200, down @ 50 m/min to see
									where deck unit fails
			12:37	36	28.027	33	37.765	2535	deck unit quit at wo=1335m, coming up @ 50 m/min
			12:41						deck unit working (seemingly) above wo=1100m
			13:09	36	28.066	33	37.805	2531	surface
End	A127-249-SL40	08 Oct 92	13:11	36	28.088	33	37.806	2504	on deck
									wire termination underwent some strain, probably
									caught on the grid on top of the sled
Begin	A127-253-SL41	08 Oct 92	16:22	36	28.018	33	37.706	2657	in the water
									reconnecting Shark-deck unit cable, approx wo=40

	A127-253-SL41	08 Oct 92							down @ 40 m/min
									deck unit locked up; wo=175
			16:37	36	28.019	33	37.725	2657	wo=300, deck unit has locked up another 2 times
			16:38	36	28.014	33	37.701	2657	wo=352, up @ 40 m/min to the surface
			16:47						wo=13, waiting for the A-frame
End	A127-253-SL41	08 Oct 92	17:04	36	28.389	33	37.570	2657	on deck
									Redid wire termination and seacable splice to sled--
									cut off 11 ft of cable. In future will keep
									speed to < = 40m/min; connection is getting trashed
Begin	A127-255-SL42	08 Oct 92	23:04	36	2.443	34	6.712	2257	in water, deck unit on, rosette NOT connected
			23:08	36	2.493	34	6.754	2261	everything looks OK, on the way down
									going down @40
			0:03	36	2.494	34	6.813	2240	wo=2207, p=2238, z=2210; winch stopped
			0:04	36	2.496	34	6.809	2242	starting new file, up @ 50
			0:50	36	2.428	34	6.898	2219	at surface, deck unit off
End	A127-255-SL42	09 Oct 92	0:53	36	2.375	34	6.850	2228	on deck
Begin	A127-256-SL43	09 Oct 92	2:07	35	53.428	34	13.006	1973	in water, deck unit on, rosette NOT connected
			2:10	35	53.390	34	13.025	2027	all OK, going down
									whoa, a ZAPS wigout @ p=250
			3:02	35	53.510	34	13.039	1994	winch stopped, 1930m wo, p=1945
			3:02	35	53.507	34	13.030	1972	coming up @ 50
			3:40	35	53.623	34	13.117	2063	saw nada, at surface, deck unit off
End	A127-256-SL43	09 Oct 92	3:42	35	53.611	34	13.111	2048	on deck
Begin	A127-269-SL44	10 Oct 92	5:07	35	18.254	34	51.836	2211	in water, deck unit on, rosette NOT connected
									All OK, going down. p~100 ZAPS went to 0
			5:21	35	18.323	34	51.786	2237	p~300 ZAPS reviving
			6:09	35	18.289	34	51.802	2224	at bottom, wo=2180, p=~2200, z=2186
									stopped recieving data again, but everyone was so
									bored w/ the traces that it wasn't noticed till it
									started up again on its on- out for ~300m (6min)
			6:57	35	18.250	34	51.981	2298	on surface, deck unit off

End	A127-269-SL44	10 Oct 92	6:59	35	18.226	34	52.019	2302	on deck
Begin	A127-274-SL45	10 Oct 92	18:23	35	12.278	34	53.906	2944	in the water
									everything looks OK, on the way down
			19:19	35	12.259	34	53.957	2950	wo = 1889; no data since p = 1812, winch stopped
									tried reset and stopped and started deck unit
			19:23	35	12.236	34	53.984	2944	up @ 40 m/min to wo = 1791
			19:24	35	12.231	34	54.009	2940	stopped @ wo = 1791
			19:42	35	12.291	34	53.985	2928	up to the surface @ 40 m/min
			20:18	35	12.553	34	54.030	3012	winch stopped at wo = 100
									up to the surf @ 40 m/min
			20:22	35	12.607	34	54.085	3035	surface
End	A127-274-SL45	10 Oct 92	20:24	35	12.615	34	54.105	3049	on deck
Begin	A127-281-SL46	11 Oct 92	19:02	35	10.583	36	20.375	3461	in the water
									looks OK, going down, working up to 40 m/min
			20:37	35	10.587	36	20.455	3484	winch stopped, wo = 3417, p = 3480, z = 3425
									starting new file; starting up @60 m/min
			21:38	35	10.907	36	20.689	3367	surface
End	A127-281-SL46	11 Oct 92	21:39	35	10.907	36	20.712	3371	on deck
Begin	A127-287-SL47	12 Oct 92	6:29	34	51.383	36	25.968		in water
			6:35	34	51.393	36	26.002	2186	all OK, going down
			7:34	34	51.300	36	26.078	2259	wo = 2230, p = 2263, z = 2236 , coming up @ 60
			8:26	34	51.385	36	26.053	2230	surface
End	A127-287-SL47	12 Oct 92	8:29	34	51.376	36	26.037	2233	on deck

Appendix 13. HYDROCAST LOG

	FAZAR		Hydrocast Log						
	FARAII								
									Commentaire
	Station ID	Date	Time	Lat	Lat'	Lon	Lon'	Depth	Comments (weather,etc.)
			GMT	°N		°W		(m)	
Begin	A127-000-HY01	04 Sep 92							down to 300 m
Begin	A127-004-HY02	04 Sep 92	13:38	33	46.045	41	40.549	3679	CTD in water; background water station
									the nephelometer shows a sinusoidal signal
									as a function of depth
			14:37						problem with the winch line readout: stuck at 2877m
									3100 decibars on the CTD readout
			14:50						readout OK ; 3355m: going on
			14:57	33	45.777	41	40.649	3669	the weight touched the bottom; cable length 3661m
			15:00						on the way up and sampling
			15:58						the nephelometer's sinusoidal signal on the screen
									is seen on the way up: but the raw digital voltages seem
									to be perfectly stable.
			16:40						CTD at surface
End	A127-004-HY02	04 Sep 92	16:43	33	54.705	41	49.442	3660	CTD on deck
									He-3 sampled from bottles 1,3,5,7,9,11,13,15
Begin	A127-006-HY03	05 Sep 92	7:23	33	14.977	39	15.206	2372	On station : setting ship up
			7:34	33	14.966	39	15.251		Rosette in the water: holding at the surface
									bouteille 1 avait ete declenchee accidtlmt sur le pont:
									elle a ete rearmee. So ....
									Bottle #2 will be the first bottle tripped, then 3,4...
									and bottle #1 will be the last tripped.
			7:43					2359	starting downcast at 20m/min building to 45m/min
			8:22						1700 m going down
			8:37					2345	On the bottom: wire out 2338
									Bottom alarm touched at both 2338 and
									again at 2326 meters of wire out
			8:40						Up at 45 m/min.No Mn plume detected on ZAPS.
				33	15.000	39	15.000		During first half of cast, ship had drifted 1,000 feet

									to the East. Now bridge is correcting to the West
									We plan to take He-3 samples from the first three
									bottles: #2 - Bottom;#3 - 40 MAB;#4 - 90 MAB
			8:56						Holding at 1600 meters depth to try and figure out
									the sinusoidal problem in Nephelometer and ZAPS
									Both signals are constant in time at a constant depth!!
			9:06						Up again at 45 m/min
			9:43	33	14.952	39	15.205	2385	CTD at surface
End	A127-006-HY03	05 Sep 92	9:49						CTD secure on deck
									robinet du bas de bouteille 9 ouvert a arrivee en
									surface. Robinet du haut bien ferme.
									La bouteille 16 n'a pas declenche: filin coince
Begin	A127-009-HY04	05 Sep 92	15:37	33	20.998	39	10.048	2311	CTD in water; begin cast
			16:17					2317	CTD continuing down...
			16:38	33	21.025	39	9.958	2333	Hit bottom and hear alarm
			17:31	33	20.865	39	9.879	2339	CTD at surface
End			17:35						Secured on deck
									He-3 samples from bottles #2, #8,#12
Begin	A127-011-HY05	05 Sep 92	21:44	33	42.421	39	3.115	2994	on station
			21:52	33	42.362	39	3.118	3015	CTD in the water and going down slowly
			23:10	33	42.406	39	3.210	3072	hit bottom, signal sounded
									He-3 samples from bottles #2, #4,#6
Begin	A127-014-HY06	06 Sep 92	14:11	33	39.500	38	11.000	4040	CTD on deck
			15:51					4070	at bottom
			17:25						secured on deck
			17:27						bottles #1,#2,#6 tripped at unknown depths
									He-3 samples from bottles #4,#5,#7
Begin	A127-019-HY07	07 Sep 92	11:13	33	55.860	37	42.099	3080	CTD in water
			12:30	33	55.732	37	42.125	3071	3063 wire out; bottom alarm sounded
			13:37	33	55.831	37	42.093	3073	CTD at surface
End	A127-019-HY07	07 Sep 92	13:40	33	55.857	37	42.105	3070	CTD secure on deck
									He-3 samples from bottles #2, #4,#6
Begin	A127-020-HY08	07 Sep 92	14:43	34	2.761	37	39.270	3279	CTD in the water

			15:10					800	error on transm data (data lost between 700-800)
									data OK when cable wiring stopped. Then data OK
									xxxxx wire out; bottom alarm sounded
			16:10	34	2.736	37	39.246	3244	CTD at Bottom; bottom rough>>up without waiting for
									alarm ringing; on the way back up
			17:22	34	2.825	37	39.140	3306	CTD at the surface
End	A127-020-HY08	07 Sep 92	17:24	34	2.862	37	39.162		CTD secured on the deck.
									He-3 samples from Bottles #2,4,6
Begin	A127-024-HY09	08 Sep 92	1:43	34	10.718	37	10.130	3222	CTD in the water. ZAPS is registering -1.14 V at the
									surface and -1.08 at 200 meters depth. Calibration
									value in van with All 3,000m. water was 3.0 V which
									should be reading + 6.0 V now on the French X2 scale.
			2:03	34	10.619	37	9.930		500 m depth : -1.02 V
									1,000 m. depth / -1.0 V.
									1500 m depth / -0.999 V
									2000 m depth / -1.004 V
			3:00	34	10.033	37	10.068	3247	3000 m depth / -1.072 V
			3:05		10.869		10.014	3267	bottom alarm, wire out = 3235 m -- on the way up
			4:16		10.736		10.198	3227	CTD out of water
End	A127-024-HY09	08 Sep 92	4:18		10.708		10.173	3220	CTD on deck
									He-3 Samples from Bottles #4, 6 and 7
Begin	A127-032-HY10	08 Sep 92	15:28	34	24.615	37	4.845	2957	CTD is in the water, ZAPS registering 2.14
									starting down...
									ZAPS registering 2.35 300MAB.
			16:47	34	24.524	37	4.768	2990	CTD on the bottom / 2981 m. wire out. Coming up
			18:08	34	24.645	37	4.888	2976	CTD at surface
End			18:10	34	24.465	37	4.888	2976	CTD on desck
Begin	A127-033-HY11	08 Sep 92	19:06	34	24.650	37	4.890	3078	CTD in water
			20:23	34	30.320	37	2.160		Alarm ring; ctd 3062M; wire out 3059M
End			27:30	34	30.332	37	2.125		CTD at surface
Begin	A127-035-HY12	09 Sep 92	1:12	34	33.954	36	34.237	3032	CTD in water
			2:27	34	34.018	36	34.252	3056	Alarm ring; CTD 3042M, wire out 3070M
End			3:39	34	34.057	36	34.335		CTD at surface

Begin	A127-042-HY13	09 Sep 92	14:04	34	51.644	36	25.938	2225	CTD in water
			15:05	34	51.675	36	25.753	2224	Alarm ring; wire out 2221M
End			15:59	34	51.700	36	26.120	2226	CTD secured on deck
Begin	A127-043-HY14	09 Sep 92	18:00	35	7.547	36	22.625	3008	CTD starting down...
			19:07	35	7.581	36	22.605	3018	CTD at bottom, alarm ring. Wire out 2969.
end			20:13	35	7.586	36	22.622	2992	CTD on deck
									He-3 sampled from Bottles #3, #4 and #7
Begin	A127-048-HY15	10 Sep 92	12:22	35	14.540	34	53.171	2862	in the water
			13:34	35	14.465	34	53.113	2864	Ctd at bottom, alarm ring; 2844 Wire out
									increase, then decrease of ZAPS, 2400M
			14:37	35	14.526	34	53.128	2861	CTD at surface
End			14:40	35	14.549	34	53.143	2859	CTD on deck; sampling
Begin	A127-055-HY16	11 Sep 92	3:35	35	39.970	34	15.177	2855	launch
			3:50						Stopped and restarted after Deck Unit Error.
			4:49	35	39.992	34	15.173	2844	CTD on Botom. 2831 Wire Out
End			5:55	35	39.989	34	15.123	2853	CTD Secure on Deck
Begin	A127-056-HY17	11 Sep 92	7:16	35	49.290	34	12.317	2611	CTD in the water
			8:21	35	49.308	34	12.240	2641	2591 m wire out, bottom alarm
			8:56	35	49.261	34	12.432	2653	wire out = 900 m, lost power to the deck unit
			9:16	35	49.294	34	12.394	2640	at the surface
End			9:23	35	49.293	34	12.402	2623	secured on deck
Begin	A127-063-HY18	12 Sep 92	0:40	36	11.173	33	57.469	3242	CTD in the water
			1:59	36	11.024	33	57.444	3239	3250m wire out, bottom alarm
End			3:12	36	11.116	33	57.421		At the surface
Begin	A127-064-HY19	12 Sep 92	4:33	36	17.875	33	46.781	2988	CTD in the water
			5:51	36	17.833	33	46.706	2995	3000 m. wire out. No Bottom Alarm. Coming up.
End			7:15						CTD on deck
Begin	A127-068-HY20	12 Sep 92	14:50	36	33.355	33	37.708	2916	CTD in the water and on the way down
			15:46	36	33.233	33	37.896	2918	CTD at bottom, alarm sounds, wire 2793-Henri say?
			16:50	36	33.253	33	37.653	2934	CTD at the surface of the water
End			16:51	36	33.256	33	37.651	2940	CTD on deck. Bottles #1 , 3 , 4 sampled

Begin	A127-071-HY21	12 Sep 92	20:31	36	37.148	33	20.697	3058	CTD in water
			20:34	36	37.147	33	20.694	3053	CTD going down...
			21:49	36	37.245	33	20.694	3053	at bottom, wire out 3039, alarm sounded.
			22:59	36	37.397	33	20.829	3146	CTD on deck
Begin	A127-074-HY22	13 Sep 92	1:44	36	45.102	33	17.653	2585	CTD in water
			1:50	36	45.207	33	17.608	2558	CTD on deck, alarm sound, tagline around sensors
			1:58	36	45.295	33	17.702	2595	CTD back in water
			3:14	36		33		2474	bottom alarm, wire out = 2564
			4:17	36		33		2546	CTD at surface, being tagged
			4:19	36	45.171	33	17.654	2574	CTD on deck
End	A127-074-HY22	13 Sep 92							He-3 samples from Bottles #1, 3, 5
Begin	A127-087-HY23	14 Sep 92	3:08	37	0.279	32	55.518	2861	CTD in the water
									no readout on the deck unit. wiring stopped
									change deck unit, error data often red. Decide to lower
									error out then OK.
			3:45						indication 02 = error bottle ?
			3:57						cable: 1000 m
									fluctuation affichage num bouteilles 1,2,3
			4:42	37	0.460	32	55.240	2940	bottom alarm, wire out = 2987 CTD:2840
									pb bottle number./ error data n'est pas reapparu
			5:41	37	0.400	32	55.400	2884	CTD at surface, being tagged/ CTD off
End	A127-087-HY23	14 Sep 92	5:43						CTD on deck
Begin	A127-091-HY24	14 Sep 92	14:51	37	14.005	32	19.216	2171	in water
			15:51	37	14.161	32	19.221	2187	hit bottom, alarm went off, 2176m wire out
			16:40	37	14.027	32	19.109	2172	on deck
End									He-3 samples taken from bottles #
Begin	A127-097-HY25	15 Sep 92	3:50	37	17.733	32	16.353	1575	in water (on axis seamount where sulfides were dredged
			4:34						hit bottom, alarm went off, 1546m wire out, CTD 1543
			4:50	37	17.700	32	16.270	1571	
			5:04	37	17.628	32	16.200	1578	CTD at surface, being tagged/ CTD off
End			5:09	37	17.632	32	16.197	1570	CTD on deck
									He-3 samples taken from #1,3,5,7,9,11,13,15

Begin	A127-102-HY26	15 Sep 92	15:23	37	47.499	31	32.002	1087	in the water
			15:56	37	47.340	31	31.990	1103	at bottom, alarm goes off, 1080m wire out
			16:25	37	47.471	31	31.916	1098	CTD on deck
									He-3 sampled from #
Begin	A127-107-HY27	16 Sep 92	1:07	37	56.504	31	29.110	1658	in the water
									error message down to 140 m/passage abouteille 2
									puis 3 (2 bout. declenchee)
			2:19	37	56.498	31	29.031	1656	at bottom, alarm goes off, 1647m wire out
			3:01	37	56.396	31	28.996	1681	at the surface
			3:03	37	56.388	31	28.998	1686	on deck
Begin	A127-112-HY28	16 Sep 92	13:46	38	7.716	30	44.161	1972	in the water, no transmission to deck unit
									four bottles are pretripped near surface
			14:01	38	7.830	30	44.226	1991	starting down; eight bottles now fired
			14:05	38	7.826	30	44.289	1996	aborted, coming up
			14:15						on deck
		16 Sep 92	15:40	38	7.631	30	44.236	1987	in the water, same location as sta #112
			16:30	38	7.850	30	44.203	2005	hit bottom, alarm sounded, wo = 1955
			17:12	38	7.742	30	44.422	1984	at surface, deck unit off
end	A127-114-HY28	16 Sep 92	17:16	38	7.744	30	44.495	2001	on deck
Begin	A127-117-HY29	16 Sep 92	21:18						in water
			21:33	38	19.225	30	37.421	881	105m wire out
			21:56	38	19.213	30	37.379	881	876m wire out, hit bottom
			22:23	38	19.211	30	37.379	883	at surface
			22:26	38	19.196	30	37.445	883	secured on deck
Begin	A127-125-HY30	17 Sep 92	9:58	38	28.977	30	15.913	2140	in water
			10:58	38	29.194	30	15.850	2135	alarm; 2160M wire out; big wire angle
end			11:50	38	29.468	30	15.841	2010	on deck

Appendix 14. HELIUM LOG

	FAZAR	A II, cruise 127			Helium Log				
									Commentaire
	Station ID	Date	Time	Lat	Lat'	Lon	Long'	Depth	Comments (weather,etc.)
			GMT	°N		°W		meters	
Begin	A127-005-HY02	04 Sep 92	16:40	33		41			CTD at surface
End			16:43	33	54.705	41	49.442	3735	CTD on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127005HY02-1A,B	1	3725		10		6.129		
	A127005HY02-3A,B	3	3600		135		6.150		
	A127005HY02-5A,B	5	3400		335		6.121		
	A127005HY02-7A,B	7	2880		855		6.026		
	A127005HY02-9A,B	9	2280		1455		5.965		
	A127005HY02-11A,B	11	1700		2035		5.882		
	A127005HY02-13A,B	13	1000		2735		5.130		
	A127005HY02-15A,B	15	397		3338		4.438		
Begin	A127-006-HY03	05 Sep 92	7:23	33	14.977	39	15.206	2372	On station : setting ship up
Bottom			8:37					2345	On the bottom: wire out 2338
End			9:43	33	14.952	39	15.205	2385	CTD at surface
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127006HY03-2A,B	2	2340		5		6.007		
	A127006HY03-3A,B	3	2300		45		5.974		
	A127006HY03-4A,B	4	2250		95		6.045		

Begin	A127-009-HY04	5-Sep-92	15:37	33	20.998	39	10.048	2311	CTD in water; begin cast
Bottom			16:38	33	21.025	39	9.958	2333	Hit bottom and hear alarm
End			17:31	33	20.865	39	9.879	2339	CTD at surface
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127009HY04-2A,B	2	2300		33		6.000		
	A127009HY04-8A,B	8	1900		433		6.021		
	A127009HY04-12A,B	12	1300		1033		5.363		
Begin	A127-011-HY05	5-Sep-92	21:44	33	42.421	39	3.115	2994	CTD in water; begin cast
Bottom			21:52	33	42.362	39	3.118	3015	Hit bottom and hear alarm
End			23:10	33	42.406	39	3.210	3072	CTD at surface
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127011HY05-2A,B	2	2978		37		5.977		
	A127011HY05-4A,B	4	2800		215		6.005		
	A127011HY05-6A,B	6	2600		415		6.032		
Begin	A127-014-HY06	06 Sep 92	14:11	33	39.5	38	11	4040	CTD on deck
Bottom		06 Sep 92	15:51					4070	at bottom
End		06 Sep 92	17:25						secured on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127014HY06-4A,B	4	3978		92		5.873		
	A127014HY06-5A,B	5	3800		270		5.795		
	A127014HY06-7A,B	7	3600		470		5.838		

Begin	A127-019-HY07	07 Sep 92	11:13	33	55.86	37	42.099	3080	CTD in water
Bottom		07 Sep 92	12:30	33	55.732	37	42.125	3071	on bottom
End		07 Sep 92	13:40	33	55.857	37	42.105	3070	CTD secure on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127019HY07-2A,B	2	3000		71		5.973		
	A127019HY07-4A	4	2800		271		5.967		end came off of sample B before crimping
	A127019HY07-6A,B	6	2600		471		5.965		
Begin	A127-020-HY08	07 Sep 92	14:43	34	2.761	37	39.27	3279	CTD in water
Bottom		07 Sep 92	16:10	34	2.735	37	39.244	3260	on bottom
End		07 Sep 92	17:24	34	2.862	37	39.162		CTD secured on the deck.
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127020HY08-2A,B	2	3150		110		5.968		
	A127020HY08-4A,B	4	3000		260		5.988		
	A127020HY08-6A,B	6	2700		560		6.033		
Begin	A127-024-HY09	08 Sep 92	1:43	34	10.718	37	10.13	3222	CTD in water
Bottom		08 Sep 92	3:05	34	10.869	37	10.014	3267	bottom alarm, wire out = 3235 m -- on the way
End		08 Sep 92	4:18	34	10.708	37	10.173	3220	CTD on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127024HY09-4A,B	4	3188		79		5.932		Bottles #1 and 2 tripped on the way down
	A127024HY09-6A,B	6	3000		267		5.983		Bottle #8 shown signs of leaking once at surface
	A127024HY09-7A,B	7	2900		367		5.979		

Begin	A127-032-HY10	08 Sep 92	15:28	34	24.615	37	4.845	2957	CTD is in the water
Bottom		08 Sep 92	16:47	34	24.524	37	4.768	2990	CTD on the bottom / 2981 m. wire out. Coming
End		08 Sep 92	18:10	34	24:696	37	4.988		CTD on deck.
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127032HY10-3A,B	3	2800		190		6.085		Bottles #2, and 4 were leaking slightly
	A127032HY10-5A,B	5	2600		390		6.005		The hose clamp opened on 5a before it was crim
	A127032HY10-7A,B	7	2400		590		6.096		but the air bubble didn't make it to the copper
									tubing before it was crimped. The sample click
Begin	A127-033-HY11	08 Sep 92	19:05	34	30.377	37	2.112	˜3070	CTD in water - Sea Beam off.
Bottom		08 Sep 92	20:22	34	30.377	37	2.127	3070	CTD at bottom - no beep. Coming up. Wire out
End		08 Sep 92	21:32	34	30.311	37	2.109	3068	CTD on deck.
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127033HY11-3A,B	3	2900		170		6.093		Bottle #2 was leaking
	A127033HY11-4A,B	4	2800		270		6.066		
	A127033HY11-6A,B	6	2600		470		6.097		
Begin	A127-035-HY12	09 Sep 92	1:13	34	33.911	36	34.256	3032	CTD in water
Bottom		09 Sep 92	2:29	34	34.017	36	34.204	3063	CTD at Bottom. Alarm Tripped. 3073 Wire out.
End	A127-035-HY12	09 Sep 92	3:45	34	34.084	36	34.483	3074	CTD on Deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127035HY12-3A,B	3	2900		163		6.086		
	A127035HY12-4A,B	4	2800		263		6.045		
	A127035HY12-7A,B	7	2600		463		6.089		

Begin	A127-042-HY13	9-Sep-92	14:04	34	51.644	36	25.938	2225	CTD in water
Bottom			15:05	34	51.675	36	25.753	2224	Alarm ring; wire out 2221M
End			15:59	34	51.700	36	26.120	2226	CTD secured on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127042HY13-3A,B	3	2100		124		6.071		
	A127042HY13-5A,B	5	1900		324		5.928		
	A127042HY13-7A,B	7	1700		524		5.985		
Begin	A127-043-HY14	9-Sep-92	18:00	35	7.547	36	22.625	3008	CTD starting down...
Bottom			19:07	35	7.581	36	22.605	3018	CTD at bottom, alarm ring. Wire out 2969.
End			20:13	35	7.586	36	22.622	2992	CTD on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127043HY14-3A,B	3	2800		218		6.096		
	A127043HY14-4A,B	4	2700		318		6.082		
	A127043HY14-7A,B	7	2500		518		6.114		
Begin	A127-048-HY15	10 Sep 92	12:22	35	14.54	34	53.171	2862	in the water
Bottom			13:34	35	14.465	34	53.113	2864	CTD at bottom, alarm ring; 2844 Wire out
End			14:40	35	14.549	34	53.143	2859	CTD on deck; sampling
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127048HY15-1A,B	1	2853		11		6.031		
	A127048HY15-3A,B	3	2700		164		6.06		
	A127048HY15-5A	5	2500		364		5.927		lost sample B
	A127048HY15-6A,B	6	2400		464		6.07		

Begin	A127-055-HY16	11 Sep 92	3:35	35	39.97	34	15.177	2855	launch
Bottom			4:49	35	39.992	34	15.173	2844	CTD on Botom. 2831 Wire Out
End			5:55	35	39.989	34	15.123	2853	CTD Secure on Deck
	Sample ID	**Rosette**	**Depth**		**approx.**		**Oxygen**		
		Number	**meters**		**MAB**		**ml/l**		
	A127055HY16-3A,C,D	3	2700		144		5.980		took three samples -A,C,D, as B broke through th
	A127055HY16-5A,B	5	2500		344		5.954		crimp. Samples C,D taken after methane
	A127055HY16-7A,B	7	2300		544		6.060		
Begin	A127-056-HY17	11 Sep 92	7:16	35	49.29	34	12.317	2611	CTD in the water
Bottom			8:21	35	49.308	34	12.240	2641	2591 m wire out, bottom alarm
End			9:16	35	49.294	34	12.394	2640	at the surface
	Sample ID	**Rosette**	**Depth**		**approx.**		**Oxygen**		
		Number	**meters**		**MAB**		**ml/l**		
	A127056HY17-3A,B	3	2400		241		6.129		
	A127056HY17-5A,B	5	2200		441		6.056		
	A127056HY17-7A,B	7	2000		641		6.043		
Begin	A127-64-HY19	12 Sep 92	4:33	36	17.875	33	46.781	2988	CTD in the water
Bottom			5:51	36	17.833	33	46.706	2995	3000 m. wire out. No Bottom Alarm. Coming up.
End			7:15						CTD on deck
	Sample ID	**Rosette**	**Depth**		**approx.**		**Oxygen**		
		Number	**meters**		**MAB**		**ml/l**		NO helium samples taken from HY18
	A127064HY19-1A,B	1	2976		19		6.044		
	A127064HY19-3A,B	3	2800		195		6.089		
	A127064HY19-5A,B	5	2600		395		6.013		

Begin	A127-68-HY20	12 Sep 92	14:50	36	33.355	33	37.708	2916	CTD in the water and on the way down
Bottom			15:46	36	33.233	33	37.896	2918	CTD at bottom, Alarm sounds, wire 2793m
End			16:50	36	33.253	33	37.653	2934	CTD at the surface of the water
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127068HY20-1A,B	1	2873		45		6.077		
	A127068HY20-3A,B	3	2700		218		6.104		
	A127068HY20-4A,B	4	2600		318		6.011		
Begin	A127-71-HY21	12 Sep 92	20:31	36	37.148	33	20.697	3058	CTD in water
Bottom			21:49	36	37.245	33	20.694	3053	at bottom, wire out 3039, alarm sounded.
End			22:59	36	37.397	33	20.829	3146	CTD on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127071HY21-1A,B	1	3047		6		6.000		
	A127071HY21-3A,B	3	2800		253		6.071		
	A127071HY21-5A,B	5	2600		453		5.983		sample 5A is questionable
Begin	A127-74-HY22	13 Sep 92	1:44	36	45.102	33	17.653	2585	CTD in water
Bottom			3:14	36		33			bottom alarm, wire out = 2564
End			4:19	36	45.171	33	17.654	2574	CTD on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127074HY22-1A,B	1	2500		74		5.962		
	A127074HY22-3A,B	3	2300		274		5.960		
	A127074HY22-5A,B	5	2100		474		5.903		

Begin	A127-87-HY23	14 Sep 92	3:08	37	0.279	32	55.518	2861	CTD in the water
Bottom			4:42	37	0.460	32	55.240	2940	bottom alarm, wire out = 2987 CTD:2840
End			5:41	37	0.400	32	55.400	2884	CTD at surface, being tagged/ CTD off
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127087HY23-5A,B	5	2850		34		5.973		
	A127087HY23-7A,B	7	2700		184		5.993		
	A127087HY23-10A,B	10	2450		434		6.021		
Begin	A127-91-HY24	14 Sep 92	14:51	37	14.005	32	19.216	2171	in water
Bottom			15:51	37	14.161	32	19.221	2187	hit bottom, alarm went off, 2176m wire out
End			16:40	37	14.027	32	19.109	2172	on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127091HY24-1A,B	1	2142		30		6.013		
	A127091HY24-3A,B	3	2000		172		5.974		
	A127091HY24-4A,B	4	1900		272		5.975		
Begin	A127-97-HY25	15 Sep 92	3:50	37	17.733	32	16.353	1575	in water
Bottom									hit bottom, alarm went off, 2176m wire out
End			5:09	37	17.632	32	16.197	1570	on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127097HY25-1A,B	1	1543		27		5.788		
	A127097HY25-3A,B	3	1500		70		5.731		
	A127097HY25-5A,B	5	1450		120		5.655		
	A127097HY25-7A,B	7	1400		170		5.63		
	A127097HY25-9A,B	9	1350		220		5.566		
	A127097HY25-11A,B	11	1300		270		5.442		
	A127097HY25-13A,B	13	1200		370		5.203		
	A127097HY25-15A,B	15	1000		570		4.740		

Begin	A127-102-HY26	15 Sep 92	15:23	37	47.499	31	32.002	1087	in the water
Bottom			15:56	37	47.340	31	31.990	1103	at bottom, alarm goes off, 1080m wire out
End			16:25	37	47.471	31	31.916	1098	CTD on deck
	Sample ID	**Rosette**	**Depth**		**approx.**		**Oxygen**		
		Number	**meters**		**MAB**		**ml/l**		
	A127102HY26-1A,B	1	1078		20		4.905		
	A127102HY26-2A,B	2	1040		58		4.912		
	A127102HY26-3A,B	3	1000		98		4.826		
	A127102HY26-4A,B	4	975		123		4.719		
	A127102HY26-5A,B	5	950		148		4.664		
	A127102HY26-6A,B	6	900		198		4.607		
	A127102HY26-7A,B	7	850		248		4.613		
	A127102HY26-9A,B	9	740		358		4.641		
begin	A127-107-HY27	16 Sep 92	1:07	37	56.504	31	29.110	1658	in the water
bottom			2:19	37	56.498	31	29.031	1656	at bottom, alarm goes off, 1647m wire out
end			3:03	37	56.338	31	28.998	1686	on deck
	Sample ID	**Rosette**	**Depth**		**approx.**		**Oxygen**		
		Number	**meters**		**MAB**		**ml/l**		
	A127107HY27-1A,B	1	0		1686				bottle tripped at surface
	A127107HY27-3A,B	3	1655		31		5.762		
	A127107HY27-5A,B	5	1550		136		5.685		

begin	A127-114-HY28	16 Sep 92	15:40	38	7.631	30	44.236	1987	in the water, same location as sta #112
bottom			16:30	38	7.850	30	44.203	2005	hit bottom, alarm sounded, wo = 1955
end			17:16	38	7.744	30	44.495	2001	on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127114HY28-1A,B	1	1955		50		5.874		
	A127114HY28-3A,B	3	1800		205		5.878		
	A127114HY28-5A,B	5	1600		405		5.77		
	A127114HY28-16A,B	16	360		1645				
begin	A127-117-HY29	16 Sep 92	21:18						in water
bottom			21:56	38	19.213	30	37.379	881	876m wire out, hit bottom
end			22:23	38	19.211	30	37.379	883	at surface
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127117HY29-1A,B	1	869		12		4.552		
	A127117HY29-3A,B	3	800		81		4.54		
	A127117HY29-5A,B	5	700		181		4.777		
begin	A127-125-HY30	17 Sep 92	9:58	38	28.977	30	15.913	2140	in water
bottom			10:58	38	29.194	30	15.850	2135	alarm; 2160M wire out; big wire angle
end			11:50	38	29.468	30	15.841	2010	on deck
	Sample ID	Rosette	Depth		approx.		Oxygen		
		Number	meters		MAB		ml/l		
	A127125HY30-1A,B	1	2138		2		6.108		
	A127125HY30-3A,B	3	2000		140		6.108		
	A127125HY30-5A,B	5	1800		340		6.031		

begin	A127-145-HY31	27 Sep 92	16:29	40	22.749	29	32.386	2811	in water
bottom			17:57	40	22.661	29	32.379	2806	alarm; 2801M wire out
end			19:10	40	22.760	29	32.387	2876	on deck
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127145HY31-1A,B	1	2808		3				
	A127145HY31-3A,B	3	2700		111				
	A127145HY31-5A,B	5	2500		311				
begin	A127-151-HY32	28 Sep 92	4:58	40	16.327	29	34.406	2676	in water
bottom			6:12	40	16.248	29	34.550	2721	alarm, 2706 wire out
end			7:18	40		29			on deck
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127151HY32-1A,B	1	2808		-132				
	A127151HY32-3A,B	3	2700		-24				
	A127151HY32-5A,B	5	2500		176				
begin	A127-176-HY33	29 Sep 92	23:11	39	0.000	29	58.000	1100	in water: weather rough. Ship speed 0.5knt. Sea
bottom		30 Sep 92	0:02	38	59.350	29	58.173	1090	alarm,1173 wire out
end			0:34	38	58.757	29	58.120	1083	on deck
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127176HY33-1A,B	1	1090		10				
	A127176HY33-3B	3	1000		100				sample questionable, clip didn't hold, duplicate lo
	A127176HY33-5B	5	900		200				sample questionable, clip didn't hold, duplicate lo

begin	A127-179-HY34	30 Sep 92	10:45	38	43.14	30	5.7	1084	in water
end			11:31	38	43.635	30	5.195	1056	alarm, p = 1037, wo = 1071
			12:07	38	43.892	30	4.592	839	on deck
	Sample ID	**Rosette**	**Depth**		**approx.**				
		Number	**meters**		**MAB**				
	A127179HY34-2A,B	2	1037		19				
	A127179HY34-4A,B	4	950		106				sample questionable, bubbles when crimping
	A127179HY34-6A,B	6	850		206				sample questionable, bubbles when crimping
begin	A127-193-SL23	01 Oct 92	20:52	37	17.624	32	16.112	1614	in water
		02 Oct 92	1:10	37	16.898	32	15.007	1951	wo = 1800, p = 1774, fired bottle #1, no confirm
			8:31	37	14.005	32	19.253	2171	fire bottle #2, p = 1973
			8:34	37	13.975	32	19.230	2163	fire bottle #3, p = 1919
			8:38	37	13.965	32	19.210	2170	fire bottle #4, p = 1808
			8:42	37	14.010	32	19.289	2171	fire bottle #5, p = 1600
			8:46	37	13.967	32	19.200	2168	fire bottle #6, p = 1400
end			9:24	37	14.181	32	19.193	2176	sled program and seasoft stopped
	Sample ID	**Rosette**	**Depth**		**approx.**				
		Number	**meters**		**MAB**				
	A127193SL23-1A,B	1	1774		177				
	A127193SL23-2A,B	2	1973		198				bottle hit, leaked some before sampling
	A127193SL23-3A,B	3	1919		244				bottle hit, leaked some before sampling
	A127193SL23-4A,B	4	1808		362				A didn't click - 'slushy'
	A127193SL23-5A,B	5	1600		571				bottle leaked when opening air valve
	A127193SL23-6A,B	6	1400		768				

begin	A127-199-SL25	2-Oct-92	21:50	37	16.789	32	14.494	2029	in water, CG pump on, Zaps on wo cartridge
			23:00	37	16.921	32	14.640	1932	fire bottle #1, p = 1800
			23:57	37	16.818	32	14.549	1931	fire bottle #3, p = 1801, midway through pump
end		3-Oct-92	0:53	37	16.826	32	14.450	2019	fire bottle #5, p = 1799 pump off
									tightened bungies in bottles 1-4 (they leaked on deck)
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127199SL25-3A,B	3	1801		130				bottle leaked when opening air valve
	A127199SL25-1A,B	5	1799		220				lost sample #1 - tube clamp didn't seal properly
begin	A127-202-SL26	3-Oct-92	4:32	37	18.720	32	18.142	1623	in water
			23:59	37	21.702	32	15.751	2281	firing bottle #3 at z = 1450
				37	21.79	32	16.246		fish position according to sled program
			0:06	37	21.673	32	15.579	2278	firing bottle #4 at z = 1750
end				37	21.79	32	16.246		fish position according to sled program
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127-202-SL26-3A,B	3	1450		831				
	A127-202-SL26-4A,B	4	1750		528				
Begin	A127-220-HY37	05 Oct 92	14:10	37	14.521	32	14.806	2083	
End			16:02	37	14.598	32	14.599		on deck
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127-220-HY37-8A,B	8	1750		333				
	A127-220-HY37-11A,B	11	1450		633				

Begin	A127-225-HY40	06 Oct 92	2:31	37	14.772	32	21.551	2235	in water from 200 m depth
			3:40	37	14.676	32	21.577	2352	wo = 2340, z = , bootom alarm
End			4:37	37	14.577	32	21.460	2330	
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127-225-HY40-8A,B	8	1700		652				
	A127-225-HY40-11A,B	11	1450		902				
Begin	A127-229-HY41	06 Oct 92	15:13	36	51.167	33	15.552	2830	in water
End			17:39	36	51.244	33	15.548	2840	on deck
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127-229-HY41-2A,B	2	2750						
	A127-229-HY41-4B	4	2550						Sample 4A lost, tube didn't seal
	A127-229-HY41-6B	6	2400						Sample 6A lost, tube didn't seal
	A127-229-HY41-7A,B	7	2350						
Begin	A127-247-SL39	08 Oct 92	5:46	36	27.691	33	37.468	2283	in water
End			9:48	36	27.626	33	37.181	2260	on deck
	Sample ID	Rosette	Depth		approx.				
		Number	meters		MAB				
	A127-247-SL39-1A,B	1	2067						
	A127-247-SL39-3A	3	2066						Sample #3B lost, tubing leaking

Begin	A127-279-HY42	11 Oct 92	13:59	35	10.580	36	16.060	3379	in water
			15:31	35	10.715	36	14.927	3375	CTD: 3354; wireout: 3346
End			16:46	35	10.750	36	16.108	3362	on deck; une bouteille decrochee retenue
									par le cordon
	Sample ID	**Rosette**	**Depth**		**approx.**				
		Number	**meters**		**MAB**				
	A127-279-HY42-1A,B	1	3354		21				
	A127-279-HY42-3A,B	3	3000		375				
	A127-279-HY42-5A,B	5	2600		775				

Appendix 15. UNOLS RESEARCH VESSEL CRUISE ASSESSMENT

1. PI/ Chief Scientist: Charles H. Langmuir
Lamont-Doherty Geological Observatory
Palisades, NY 10964

PI/Chief for water program:
Gary Klinkhammer
College of Oceanography
Oregon State University
Corvallis, OR 97331

2. SHIP: ATLANTIS II Voyage #127 Legs 1 & 2

4. General Type of Work
We carried out 300 stations of dredging, rock coring, vertical hydrocasts, and sled tows.

5. Cruise ID's
Atlantis II 127 Legs 1 & 2
The FAZAR expedition (French American ZAPS and Rocks)

6. Area of Operations
Mid-Atlantic Ridge between 32°N and 41°N.

7. Cruise dates
Leg 1 August 29, 1992 - September 19, 1992
Woods Hole to Punta Delgada
Leg 2 September 23, 1992 - October 20, 1992
Punta Delgada to Woods Hole

8. Days Total: 50 Days Transit: 23 Days Stations: 26
Days Surveying: 1

12. The mission was fully successful, in that we more than accomplished the work plan detailed in our NSF proposal.

13. We originally requested the Maurice Ewing.

14. The personnel at Woods Hole Oceanographic Institution were very helpful prior to the cruise. However, we were under the impression until the last minute that we would have an experienced deck and station
(dredging and coring) person as the sea-going technician. This person was replaced by Skip Gleason, who did a superb job with the Dynacon winch, but did almost no deck work. We had sufficient experience in the science party that this was not a problem, but if we had been counting on the experienced WHOI technician to lead the deck aspects of the station work, we might have been in serious trouble.

15. Weather Delays.
We lost two and half days to Hurricane Charley and Tropical Storm Bonnie. Because the time lost was pure science time, this represented 10% of our total science effort, and was a significant burden. It meant we lost at least one hydrothermal survey of an active ridge segment, and as many as 20 rock sampling stations.

16. Work lost due to ship personnel or equipment

In general the ship and ship personnel performed superbly, and their level of professionalism and willingness to help were exceptional. However, there were two things that did lead to significant loss of ship time. First, we had been told that the trawl winch could operate at 75 meters/minute, but found on our first dredge station that the maximum speed on the meter was 55 meters/minute. Actual speed calculated from the dredge log was about 60 meters/minute. In 3000 meters of water, the difference between 60 and 75 meters/minute leads to a loss of time of 20 minutes for each station. Late in the second leg, something mysterious happened to the winch controls, and the winch could go at over 100 meters/minute. Acceptable and safe winch speeds then became 70-75 meters per minute. Actual speeds calculated from the dredge log were 75-80 meters per minute. By this time, more than 40 dredges had been completed. If the more rapid winch speeds had been available throughout the cruise, there would have been 15 hours of time saved--almost a full day of ship time! If the winch were able to safely operate at 100 meters per minute for 60 dredges in 3000 meters of water, then several days of ship time could be saved during a 30 day cruise. These speeds were obtainable on the AII winch in the latter part of the cruise, but were not allowed due to concerns about the brake. Given the short supply and very high cost of ship time, substantial investment to make the trawl winch able to operate at these speeds would be desirable. $50,000 of ship time could be saved in a 30 day leg!

The slow trawl winch speeds for much of the work were balanced by the fact we had been told that the hydrowinch would go only 80-90 meters/minute. Upon arrival, we found it could go 150 meters/minute. This increased speed was a marvelous boon to our rock sampling program, and allowed us to obtain 50% more rock coring stations. In view of these miscommunications concerning both winches, it is clear that there needs to be better communication between the ship, the port office and the PI's concerning winch speeds, and ship personnel should be aware that 75 meters/minute for the trawl winch is possible and works well.

The second loss of ship time occurred because the second mate, Elizabeth McLeod, was inexperienced with station work. Apparently this was her first cruise in which precise scientific station work had been demanded. Her performance suffered by comparison with the superb ship handling of the first and third mates. The second mate tried very hard, and cannot be faulted for her level of effort and concern. However, during her watch it took significantly longer to get set up on station, and it was not possible for much of the cruise, particularly in non-ideal weather, for her to hold station adequately over precise targets. On her watch a dredge was lost when the wire got caught in the starboard screw upon recovery. Some stations had to be repeated on a different watch in order to sample small targets, and we had to modify our science plan to take into account when she would be on watch. The combined problems led to a loss of about a day of ship time over the two month period. By the end of the two month period, her performance was much improved. Since a day of AII time is worth $17,000, it does not seem acceptable to have science time lost because of inadequate mate training or experience. For a cruise involving demanding station work such as ours, some special arrangements should be made so that either the mates are sufficiently experienced, or the new mate receives extra help and instruction to learn the ropes more quickly. I emphasize that the second mate tried very hard, however, and was helpful to us in other areas, such as her work in the chartroom. This is more a training and management problem rather than a problem with an individual.

17. Work lost due to-user provided scientific equipment

The water sampling part of the cruise utilized complex equipment that is still in the developmental stages. There were many and diverse technical problems with this equipment, which led to substantial losses of time for data acquisition. This is to be expected during instrument development.

18. See discussion above. There were also some power problems, but we were able to work around these with the help and cooperation of the ship's engineers. These are more fully discussed in comments below.

19. Equipment used: A-frame, crane, trawl winch, hydro-winch, Dynacon portable winch, Seabeam, computers. WHOI also provided an air winch that was indispensable for deployment and recovery of the rock cores over the starboard side.

20. Safety related problems:

One scientist fell out of a top bunk during a gale in the latter part of the second leg, fortunately without injury. Many of the science party felt the bunks, particularly the top bunks, should have guard rails, and that they were not safe in rough weather.

21. General Comments

The cruise was a successful one, and Woods Hole ship operations and the Atlantis II crew should be commended for the cooperative spirit and professionalism with which they helped us to get our science done. The attitude of all personnel was based on how to make the science operations run smoothly and successfully. This attitude and the helpful actions it generated are a tribute to WHOI personnel and their long-standing tradition of excellence in sea-going science.

Many specific positive aspects stand out:

(1) Making Alvin space and cabins available to us helped enormously, both in getting science done and in the general comfort and happiness of the scientific party. Rock coring preparation and chemical analysis took place in the Alvin labs, and we were able to use four of the five Alvin cabins. Releasing this space for science showed flexibility on the part of Woods Hole and the Alvin group that should make other scientists more interested in using the AII for non-Alvin cruises when the possibility arises. It helped us, and should help Woods Hole in the long run.

(2) Shore personnel at Woods Hole, particularly Don Moller, Barry Walden, Dick Edwards and Hovey Clifford worked very hard prior to the cruise to make sure the ship was set up properly and that our needs were fulfilled.

(3) Providing us with the Dynacon winch proved to be essential for the success of our mission, and Woods Hole undertook the major task of providing and operating the winch free of extra charge. This was a sacrifice on their part that made the science program work, and it is much appreciated. The Dynacon winch is a superb tool that functioned perfectly-- it should be much in demand from the scientific community. Skip Gleason took good care of the winch and operated it with perfection.

(4) The mates worked exceptionally hard and well with round-the-clock station work over a two month period. Going up on the bridge during stations was to see professionalism at work.

(5) The deck crew was always helpful, gave instruction where needed, and showed great interest in the over-the-side operations and scientific results. They were a pleasure to work with.

(6) We made extensive use of e-mail and other communications through the radio operator. E-mail worked very well, and the radio operator provided exceptional service, and was always willing to help us with our communication needs, and to help with electronics problems as they arose. Other UNOLS ships should take the Atlantis II operations as a standard, and e-mail should be freely available on all vessels. The e-mail was indispensable for science operations and communications on this leg.

(7) The food was excellent. Many of the scientists on board felt the food was the best they had experienced on a US research vessel. This was particularly true on the first leg, before the overtime restrictions were put into effect by Woods Hole.

(8) Captain and Chief Engineer were always helpful and concerned with the success of the scientific program as well as the safety and operation of the ship. They were a pleasure to work with on a daily basis.

(9) Seabeam operations were very smooth. Seabeam worked steadily throughout the two legs, with virtually no down time. Joyce Miller and Shef Corey provided us with excellent plots and data on a very short time frame. Shef Corey worked exceptionally hard and well on Leg 2.

(10) Phil Treadwell, the deck engineer, helped us almost on a daily basis during leg 1 with diverse problems. His willingness to help and make suggestions and the high quality of his work were much appreciated.

(11) We were very concerned with the ancient hydro-winch during pre-cruise planning. WHOI responded to these concerns by doing work on the winch prior to the cruise, and the winch worked steadily at high speeds for hours a day for two months with no significant breakdowns and only one minor brake adjustment. Two months of flawless high speed operation would be exceptional for any winch. The performance of this 1960's winch in 1992 is a tribute to the care and maintenance of this tool over a long period of time by WHOI.

These positive aspects far outweigh difficulties that arose during the cruise. One difficulty was the electrical system on the AII. When only one generator was running, sensitive electronic instrumentation did not run properly. Running two generators was onerous, so we were restricted to electronics operation for limited time intervals during the day. Seabeam also had to be turned off prior to any major piece of equipment being turned on. We were able to work around these power problems, but restrictions on science operations due to inadequate electrical power are clearly not optimal.

A second difficulty does not directly relate to science operations, but did in fact have a very negative impact on both science and crew. A day or two after leaving Ponta Delgada on the second leg, WHOI imposed stringent overtime restrictions. This upset the crew greatly, and markedly changed the attitudes on board. The scientific party had to take more responsibility for deck work, and the helpful attitude that was so apparent on the first leg dissipated. The crew was simply not as available due to time restrictions. The crew maintained their professionalism in making sure the science got done, but the atmosphere of the ship changed. The food became worse. We had had the day man helping with deployments at night, and suddenly one night he was not there, without the science party being notified. We were fortunate in having sufficient manpower and technical expertise on board to handle most things adequately, but there were potentially unsafe situations, and there was a clear tension between trying to fulfill WHOI's restrictions and making sure all jobs were adequately accomplished.

But let's not forget the bottom line. Woods Hole exhibited professionalism and helped enormously in getting the science done. Their cooperation allowed us to have a successful mission despite the loss of 10% of our science time. We are very appreciative of their efforts.